(8) Floodplain Forests

Description:

Floodplain forests comprise a variety of nontidal and tidal forest habitats that occur along streams and rivers and their adjacent floodplains. Examples of floodplain forests can be found statewide but some of the largest tracts occur on the Upper and Lower Coastal Plain. Along tidally influenced rivers in these regions, broad expanses of floodplain forests occur between gradually sloping uplands on the landward side and tidal shrublands followed by oligohaline and/or mesohaline marshes bordering the river channel. The forest canopy is often semi-open and, along many river sections, there is a gradual forest-shrubland-marsh wetland ecotone. Tidal floodplain forests range from bald cypress dominated swamps in parts of the Pocomoke River watershed to gum-maple (black gum, red maple, sweetgum) and red maple-green ash dominated bottomlands. At slightly higher elevations on hammocks and near the floodplain-upland edges, loblolly pine, sweetgum, and various oaks may be frequent. In the Nanticoke and Pocomoke river watersheds, Atlantic white-cedar also occurs in the upper or inland sections of tidal floodplain forests, mostly as scattered individuals but occasionally in small isolated stands. Atlantic white-cedar and bald cypress were formerly much more widespread and common on the lower Eastern Shore but were heavily logged out by the early 1900s. The shrub layer in tidal floodplain forests is usually dense and diverse often including species, such as northern arrow-wood, winterberry, silky dogwood, swamp azalea, swamp rose, fetterbush, and sweet pepperbush. Climbing vines are common in multiple layers and may include species such as common wild yam, poison-ivy, common greenbrier, and Virginia creeper. Pronounced hummock-and-hollows microtopography is characteristic of tidal floodplain forests. Hollows are regularly inundated by tidal water, whereas hummocks are less frequently flooded thus supporting the establishment of trees and mesophytic herbs. High species richness in the herb layer can be attributed to flooding frequency and hummock-and-hollow microtopography. Regularly flooded hollows support many flood-tolerant swamp species such as jewelweed, arrow arum, halberd-leaf tearthumb, lizard's-tail, and sedges such as tussock sedge. Elevated above normal high tides, hummocks provide habitat for marsh blue violet, water-hemlock, greenfruit clearweed, false nettle, and ferns such as royal fern, cinnamon fern, and marsh fern.

In brackish river systems, small fringing tidal woodlands dominated by loblolly pine occur along portions of tidal rivers and creeks, in narrow ecotones between "high salt marshes" and adjacent uplands, and as islands within extensive salt marshes. Examples of these tidal

floodplain forests can be found in the lower "tidewater" areas of Dorchester, Wicomico, Somerset, Worcester and St. Mary's counties. Frequency of tidal flooding is variable, often less than daily due to fluctuations in groundwater levels and landscape position. These habitats are species poor, with loblolly pine often forming a monospecific canopy and southern bayberry comprising the shrub layer. Indicative of brackish conditions, species diversity in the herbaceous layer is quite low and chiefly comprised of halophytic vegetation. Most frequent and dominant of these include small saltmeadow cordgrass, switchgrass, and saltgrass.

Nontidal floodplain forests on Maryland's Coastal Plain are very diverse. Swamp forests extend up to the river's edge, replacing the forest-shrub-marsh ecotone frequently found along tidal river sections. These seasonally flooded swamps are often dominated by combinations of green ash, red maple, sweetgum, swamp tupelo, willow oak, and overcup oak. Well-drained levees support swamp chestnut oak, cherrybark oak, American elm, and river birch is often abundant in disturbed, cut-over stands. Along small streams, trees typical of both levees and swamps may occur in mixed stands. On exceptionally well-drained small stream bottoms, tulip-poplar is often important. Small tree, shrub, and herbaceous composition are highly variable between sites.

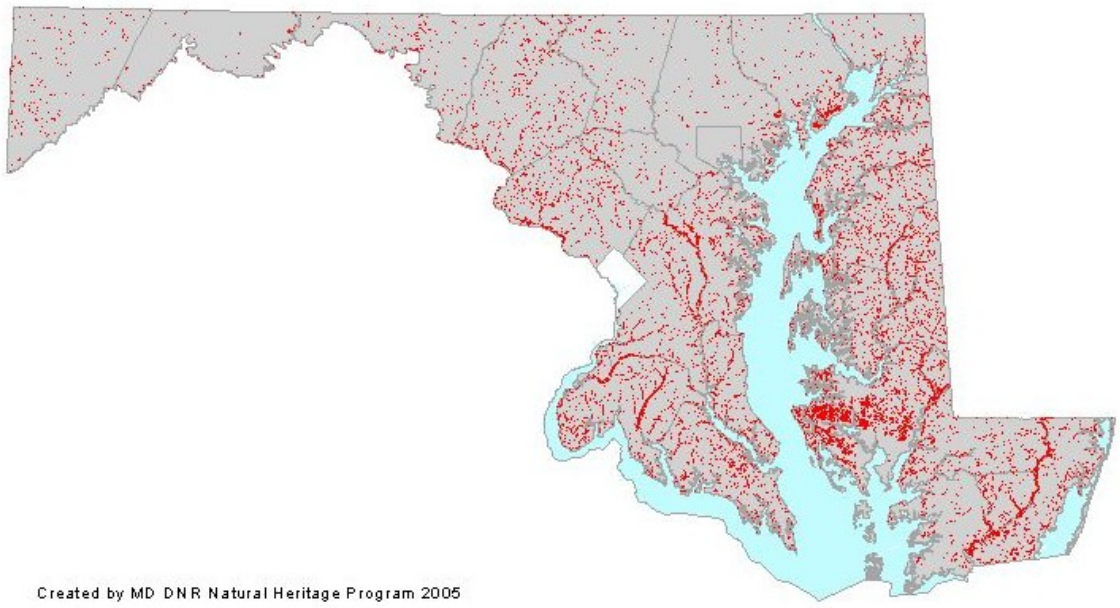
In the Piedmont and Ridge and Valley provinces, most large stream and river floodplains consist of temporarily to intermittently flooded bottomland forests, dominated by sycamore, silver maple, boxelder, and American elm. Alluvial landforms such as gravel bars, levees, terraces, old oxbows and sloughs are usually present. Young, flood-scoured woodlands sometimes occur along shoreline areas and islands, especially in high-gradient rocky sections and along flood-deposited sand and gravel bars. Such areas are frequently dominated by dense, nearly pure stands of small (2-8 m tall) sycamore, boxelder, river birch and green ash trees. Embedded within floodplain forests are floodwater pools and seasonally flooded backswamps and sloughs dominated by red maple, silver maple, pin oak, swamp white oak, and sweetgum. These backwater areas usually exhibit distinctive hummock-and-hollow microtopography with maximum flood depths of 50-70 cm. Along smaller streams, where the floodplain is narrower and alluvial landforms occur at much smaller scales, floodplain forests also include more mesic species such as tulip poplar, sugar maple, basswood, American beech, eastern hemlock, and white pine. Small tree, shrub, and herbaceous composition are highly variable between sites. Farther west, on the Allegheny Plateau, northern hardwoods and northern conifers such as eastern hemlock, yellow birch, and black cherry tend to dominate and the understory often contains dense thickets of great-laurel.

Location and Condition:

Extensive tracts of floodplain forests remain along some of the streams and rivers of the Coastal Plain, especially in the Pocomoke, Nanticoke, Choptank and Patuxent drainages. However, many of these waterways, especially the smaller tributaries, have been ditched and channelized and the remaining floodplain forests areas have been drained and cleared for agriculture. From the Piedmont westward, many of the largest floodplain forests occur along the Potomac River and its major tributaries. However, much of this habitat has been converted to cropland or pasture, with concomitant decreases in stream water quality. Many floodplain forests also have been impacted by logging, dams and rapidly expanding

populations of invasive species. On the lower Eastern Shore, logging has significantly reduced the extent of bald cypress and Atlantic white-cedar. Floodplain forests have also been impacted by changes in stream and river hydrology and declines in water quality due to reductions in forest cover and increases in impervious surfaces in the surrounding watershed.

Figure 4.8 Location of Floodplain Forests in Maryland (Sources: USFWS NWI; FEMA; MD DNR MBSS/Versar Inc.)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Bobcat
Delmarva fox squirrel
Eastern red bat
Hoary bat
Indiana bat
Least weasel
Rafinesque's big-eared bat
Silver-haired bat
Southeastern myotis
Southeastern shrew
Southeastern star-nosed mole
Southern pygmy shrew
Southern water shrew
Birds
Acadian flycatcher
American black duck
American redstart
American woodcock

Bald eagle
Bank swallow
Barred owl
Bicknell's thrush
Black-and-white warbler
Black-billed cuckoo
Blackburnian warbler
Black-crowned night-heron
Black-throated blue warbler
Black-throated green warbler
Blue-headed vireo
Broad-winged hawk
Brown creeper
Brown-headed nuthatch
Canada warbler
Cerulean warbler
Golden-crowned kinglet
Great blue heron
Great egret

Hairy woodpecker
Hermit thrush
Hooded warbler
Kentucky warbler
Louisiana waterthrush
Magnolia warbler
Northern parula
Ovenbird
Pileated woodpecker
Prothonotary warbler
Red-eyed vireo
Red-headed woodpecker
Red-shouldered hawk
Scarlet tanager
Solitary sandpiper
Swainson's warbler
Veery
Wayne's black-throated green warbler

Wood thrush
Worm-eating warbler
Yellow-crowned night-heron
Yellow-throated vireo
Reptiles
Bog turtle
Broad-headed skink
Common ribbonsnake
Eastern box turtle
Eastern spiny softshell
Northern map turtle
Northern red-bellied turtle
Queen snake
Rainbow snake
Red-bellied watersnake
Spotted turtle
Timber rattlesnake
Wood turtle
Amphibians
Carpenter frog
Eastern mud salamander
Eastern narrow-mouthed toad
Eastern spadefoot
Jefferson salamander

New Jersey chorus frog
Inverts: Dragonflies & Damselflies
Aurora damsel
Blue-faced meadowhawk
Cyrano darner
Fine-lined emerald
Harlequin darner
Robust baskettail
Taper-tailed darner
White-faced meadowhawk
Inverts: Butterflies & Moths
Baltimore checkerspot
Carolina satyr
Chermock's mulberry wing
Cypress sphinx moth
Dion skipper
Giant swallowtail
Golden-banded skipper
Great purple hairstreak
Hessel's hairstreak
King's hairstreak
Long dash
Marbled underwing
Northern crescent

Palamedes swallowtail
Pepper and salt skipper
Precious underwing
West virginia white
Inverts: Dipterans
Pitcher-plant mosquito
Inverts: Beetles
Appalachian Tiger Beetle
Giant stag beetle
Inverts: Freshwater Crustaceans
An entocytherid ostracod
An entocytherid ostracod
Rare Natural Communities
Riverside Outcrop Barrens
Floodplain Ponds and Pools
Piedmont/Mountain Swamp Forests
River-Scour Woodlands
Riverside Prairies
Atlantic White Cedar Wetlands
Estuarine Fringe Loblolly Pine Forests
Tidal Bald Cypress Woodlands/Forests

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, sika deer, black bear, eastern gray squirrel, eastern fox squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink, northern river otter, American beaver, muskrat, woodchuck, wild turkey, ruffed grouse, northern bobwhite, American woodcock, mourning dove, American crow, and fish crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to other land uses or forest types that results in loss of habitat
b. Pesticide use and contamination that directly or indirectly affects GCN species
c. Incompatible silviculture practices that result in degradation of habitat
d. Development and land use, including roadways and trails that results in forest fragmentation and isolation
e. Deer overbrowsing or other causes that result in loss of forest structural diversity
f. Forest pest species that may have landscape level effects
g. Invasive/exotic species that result in degradation of habitat

h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Incompatible agricultural practices such as ditching, channelization, livestock grazing, inadequate buffers, and pond construction that result in habitat degradation
j. Development and roads that cause reduced water quality and hydrological changes
k. Encroachment by woody vegetation or buffer planting on riverine prairies and rare herbaceous species
l. Altered natural disturbance patterns resulting in inadequate habitat conditions for certain GCN species
m. Acid mine drainage
n. Groundwater withdrawal for residential, commercial, and agricultural use that results in hydrologic changes
o. Removal of beaver populations
p. Human disturbance, including ATV use, that results in degradation of habitat

Conservation Actions:

a. Restore floodplain forests including reestablishment of old growth, natural hydrology, and improved water quality ***[Measure: # of acres restored]***

b. Conserve large blocks of contiguous forest where appropriate ***[Measure: # of acres contiguous forests conserved]***

c. Improve storm water management practices and sediment erosion control measures to avoid/minimize development impacts to forested wetland areas and surrounding watershed ***[Measure: # of development projects near forested wetlands with improved storm water and sediment management incorporated into plans]***

d. Establish and maintain landscape-scale protected habitat and movement corridors ***[Measure: # of existing targeted large forested patches connected by new corridors; # of acres new corridors established]***

e. Promote and support watershed-based initiatives to restore and protect watersheds ***[Measure: # of watershed-based initiatives implemented]***

f. Minimize fragmentation of large, contiguous forest blocks ***[Measure: % of large forest blocks remaining unfragmented]***

g. Establish and maintain adequate forest buffers along streams and rivers ***[Measure: # of miles of stream/river forested buffers established and maintained]***

h. Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies ***[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]***

i. Work with farming community to conserve, restore, and protect floodplain forests *[Measure: # of acres floodplain forest protected or restored from agricultural use; # of sites with cooperative management projects]*

j. Enforce and modify, as needed, nontidal wetland protection regulations especially as they relate to Wetlands of Special State Concern *[Measure: # of regulation modifications proposed; # of violations prosecuted; # of citations issued]*

k. Develop habitat management guidelines for use by foresters and land managers and work with them to implement such *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*

l. Develop and implement protocols to control invasive species in a manner compatible with GCN species *[Measure: # of protocols developed; # of sites with management implemented]*
m. Protect target riverside prairie habitat *[Measure: # of acres protected]*
n. Develop and implement protocols to control deer populations to reduce browsing levels *[Measure: protocols developed; # of sites or acres with management implemented]*
o. Maintain natural beaver populations *[Measure: # of viable beaver populations; # of miles of stream influenced by beaver activity]*
p. Remove certain dams to allow for flooded areas to revert back to forest *[Measure: # of dams removed; # of acres reverted to floodplain forest]*
q. Work with watershed groups to encourage forest conservation as a strategy for water conservation *[Measure: # of groups contacted; # of cooperative projects and meetings with watershed groups]*
r. Limit the use of pesticides such that GCN species and this habitat are not adversely affected *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
s. Restore degraded habitats through appropriate techniques *[Measure: # of sites or acres with degraded habitat restored]*
t. Implement appropriate IPM practices to minimize the effects of serious forest pest species *[Measure: # of sites or acres with IPM practices implemented]*
u. Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

a. Conduct surveys to better determine the distribution, abundance, population strongholds and status of GCN species, especially odonates, southern water shrew, bats, reptiles, amphibians, butterflies, and forest interior birds *[Measure: # of surveys completed]*
b. Conduct research on life history, habitat requirements, metapopulation dynamics and movement/dispersal patterns of GCN species *[Measure: # of research projects conducted; # of research papers published]*
c. Determine effective buffer widths as it relates to development, timber harvesting and farming practices; include upland life zone requirements of reptiles and amphibians, foraging areas for bats, and area-sensitive species like forest interior birds and bobcat *[Measure: # of research projects conducted; # of research papers published]*
d. Monitor habitat conditions and GCN species, especially those that serve as effective indicator, umbrella or keystone species, and species for which population trend data are most urgently needed *[Measure: # of monitoring studies established; # of monitoring studies conducted]*

(9) Upland Depressional Swamps

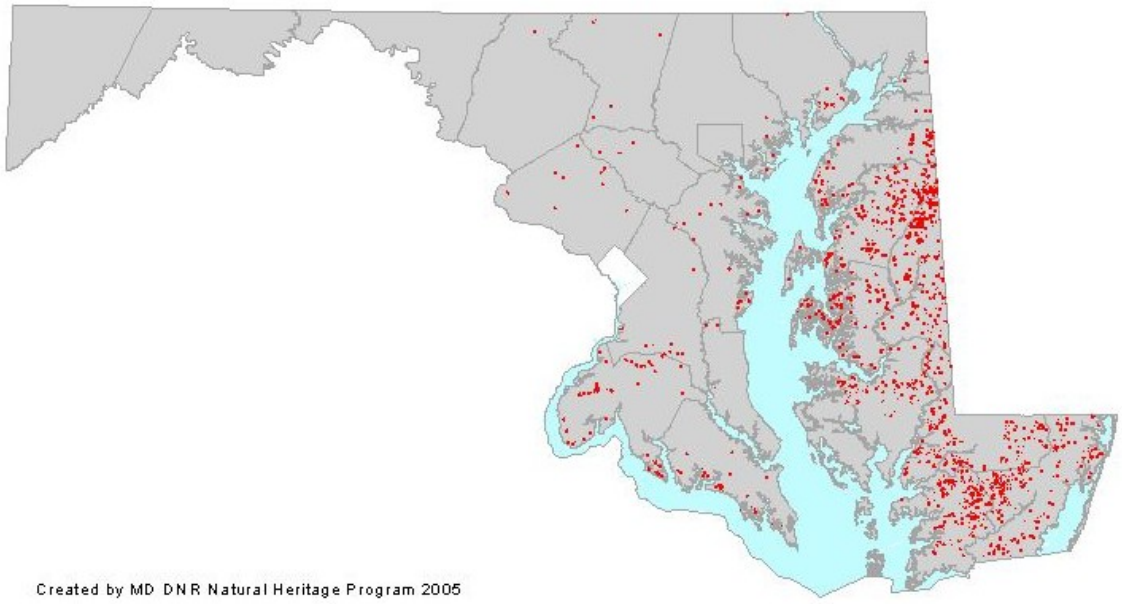
Description:

Upland depression swamps are seasonally flooded forested wetlands in the Piedmont and Coastal Plain. In the Piedmont, upland depression swamps are isolated, depressional wetlands characterized by shallow bedrock or clay hardpans that impede soil drainage. In the Coastal Plain, these habitats form in basin depressions on hardpan soils with shallow seasonal flooding induced by perched water tables. This results in standing water throughout the early part of the growing season, followed by a period of drawdown. Hydroperiods are variable between swamps and largely dependent on rainfall and drought cycles. The forested canopy structure of upland depression swamps ranges from open to closed and is primarily oak-dominated with other hardwoods less frequent. Common tree species include willow oak, pin oak, swamp chestnut oak, green ash, red maple, and black gum. In the understory, shrubs and vines are common but variable, often including an abundance of common greenbrier. The herbaceous layer is often sparse and may include species of sedges, manna-grasses, and rushes. Slightly elevated hummocks of sphagnum mosses frequently form large patches. Upland depression swamps are isolated wetlands subject to major disturbances such as logging, draining, and development. In Maryland, many community types associated with upland depression swamps are considered rare.

Location and Condition:

Upland depression swamps are widespread throughout the Coastal Plain occupying broad flats between drainage streams. Swamps with clay hardpan soils are most numerous in Queen Annes, Dorchester, Wicomico, Somerset, and Worcester Counties. In the Piedmont, upland depression swamps are scattered but are most numerous in Triassic basins. Documented sites are found over areas of Balls Bluff siltstone, diabase, and bedrock terraces of the Potomac River. The majority of upland depression swamps have been altered through logging, draining, development, and conversion to agriculture. Relatively few high quality examples remain.

Figure 4.9 Location of Upland Depressional Swamps in Maryland (Sources: USFWS NWI)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Bobcat
Eastern red bat
Hoary bat
Southeastern myotis
Southeastern shrew
Southeastern star-nosed mole
Southern pygmy shrew
Birds
Acadian flycatcher
American redstart
American woodcock
Barred owl
Black-and-white warbler
Black-billed cuckoo
Blackburnian warbler
Black-throated blue warbler
Black-throated green warbler
Brown creeper
Brown-headed nuthatch
Canada warbler
Great blue heron
Great egret
Hairy woodpecker
Hooded warbler

Kentucky warbler
Louisiana waterthrush
Magnolia warbler
Northern waterthrush
Ovenbird
Pileated woodpecker
Prothonotary warbler
Red-shouldered hawk
Scarlet tanager
Swainson's warbler
Wayne's black-throated green warbler
Wood thrush
Reptiles
Common ribbonsnake
Northern red-bellied turtle
Spotted turtle
Amphibians
Carpenter frog
Eastern mud salamander
Eastern spadefoot
New Jersey chorus frog
Inverts: Dragonflies & Damselflies
Amber-winged spreadwing
American emerald

Atlantic bluet
Attenuated bluet
Aurora damsel
Azure bluet
Bar-winged skimmer
Beaverpond baskettail
Black-tipped darner
Blue-faced meadowhawk
Burgundy bluet
Canada darner
Chalk-fronted skimmer
Cherry-faced meadowhawk
Comet darner
Cyrano darner
Dot-tailed whiteface
Eastern red damsel
Elfin skimmer
Emerald spreadwing
Four-spotted pennant
Golden-winged skimmer
Great spreadwing
Hagen's bluet
Harlequin darner
Little blue dragonlet
Lyre-tipped spreadwing

Mantled baskettail
Pale bluet
Petite emerald
Rainbow bluet
Sedge sprite
Seepage dancer
Ski-tailed emerald
Slender bluet
Southern sprite
Sphagnum sprite
Spotted spreadwing
Spring blue darner
Stripe-winged baskettail
Sweetflag spreadwing

Taper-tailed darner
Treetop emerald
Tule bluet
Vesper bluet
White corporal
White-faced meadowhawk
Yellow-sided skimmer
Inverts: Butterflies & Moths
Baltimore checkerspot
Dion skipper
Great purple hairstreak
Hessel's hairstreak
King's hairstreak
Palamedes swallowtail

Pepper and salt skipper
Precious underwing
Inverts: Dipterans
Pitcher-plant mosquito
Inverts: Beetles
A dytiscid beetle
A hydrophilid beetle
Inverts: Freshwater Crustaceans
An entocytherid ostracod
An entocytherid ostracod
Rare Natural Communities
Atlantic White Cedar Wetlands

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, eastern gray squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink, northern river otter, muskrat, American woodcock, mallard, wood duck, American crow, fish crow, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Incompatible silviculture practices that results in habitat degradation
j. Nontarget impacts of gypsy moth control
k. Mosquito control practices (larvicides, adulticides, introduction of *Gambusia*)
l. Human disturbance, including ORV use, that results in habitat degradation
m. Decline of Atlantic white cedar in the Coastal Plain
n. Hemlock wooly adelgid that cause loss of hemlock component

Conservation Actions:

a. **Protect and restore best remaining upland depressional wetlands** ***[Measure: # of acres of priority upland depressional wetlands protected and restored]***
b. **Enforce and modify, as needed, nontidal wetland protection regulations especially as it relates to Nontidal Wetlands of Special Concern** ***[Measure: # of regulation modifications proposed; # of violations prosecuted; # of citations issued]***
c. **Establish and maintain effective buffers along wetlands by restoring natural communities where possible** ***[Measure: # of miles wetland buffers established; # of acres of natural communities restored adjacent to wetlands]***
d. **Work with farming community to restore and protect wetlands through NRCS, FSA, USFWS, and MDA programs** ***[Measure: # of acres wetland restored and protected]***
e. **Protect wetlands through acquisitions and easements** ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***
f. **Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology** ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***
g. **Incorporate wetland conservation actions into land planning efforts and public land management plans** ***[Measure: # of acres of wetlands conserved during land planning efforts; # of public land management plans incorporating wetland wildlife focused habitat conservation actions]***
h. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*
i. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*
j. Limit development impacts within wetland areas and surrounding watershed *[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]*
k. Regulate mosquito control, gypsy moth control, and control of other pests in upland depressional wetlands and surrounding landscape *[Measure: # of sites with reduced quantity or frequency of pesticide use and other control methods]*
l. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*
m. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*
n. Develop and implement protocols to control invasive species and prevent their establishment *[Measure: # of protocols developed; # of sites with management implemented]*
o. Provide sufficient landscape connectivity *[Measure: # of wetland sites with sufficient landscape connectivity]*
p. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*
q. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*
r. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*
s. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*
t. Educate public about human disturbance issues *[Measure: # of educational materials developed and distributed]*

u. Restore hemlock/Atlantic white cedar component where feasible *[Measure: # of acres upland depressional wetland with hemlock/Atlantic white cedar components restored]*

Inventory, Monitoring and Research Needs:

a. Conduct surveys to better determine the distribution, characteristics and condition of upland depressional wetlands *[Measure: # of surveys completed]*
b. Conduct surveys to better determine the distribution, abundance, population strongholds and status of GCN species, especially odonates, reptiles, amphibians, and butterflies *[Measure: # of surveys completed]*
c. Conduct research on life history, habitat requirements, metapopulation dynamics and movement/dispersal patterns of GCN species *[Measure: # of research projects conducted; # of research papers published]*
d. Determine effective buffer widths as it relates to development, timber harvesting, and farming practices; include upland life zone requirements of reptiles, amphibians, foraging areas for bats, and area-sensitive species like forest-nesting birds and bobcat *[Measure: # of research projects conducted; # of research papers published]*
e. Monitor habitat conditions and GCN species, especially those that serve as effective indicator, umbrella or keystone species, and species for which population trend data are most urgently needed *[Measure: # of monitoring studies established; # of monitoring studies conducted]*

(10) Carolina Bays

Description:

Carolina bays (also known as Coastal Plain ponds and Delmarva bays) are rare habitats generally described as shallow, seasonally flooded depression wetlands on Maryland's Lower Coastal Plain. Research suggests these habitats developed from ancient interdunal depressions approximately 16,000 years ago when the climate of the Coastal Plain was very cold and windy and supported an extensive sand dune ecosystem. The majority of Carolina bays have been shaped by these wind processes into elliptical depressions up to one meter in depth with prominent sand rims. A perched water table and seasonal fluctuations in groundwater recharge and precipitation cause these wetlands to be irregularly flooded or seasonally inundated. During very dry seasons, surface water may be absent or limited to the deepest point within the bay. Likewise, during very wet years when rainfall is abundant, bays may retain water throughout the entire growing season. Depth and duration of seasonal inundation are apparently the most important factors influencing plant communities and the degree to which woody species become established. Dry-season fires in adjacent uplands may spread into bays and may be another factor limiting the invasion of woody species, although fire frequencies throughout the region have been much reduced in recent decades. The vegetation of Carolina bays is closely linked to its hydrologic regime. As water levels draw down or recede during the growing season, plant communities typically develop concentric rings from the outer edge towards the center or deepest point in the bay. Outer rings of a bay may include shrubs of buttonbush, fetterbush, swamp loosestrife, and sweet pepperbush or nearly monospecific stands of Walter's sedge, maidencane and Virginia chain fern. Interior portions of bays may include species such as Eaton's witchgrass, warty panicgrass, and Virginia meadow-beauty. Many of these species grade into the "draw down pocket" or lowest portion of a bay, which is the last to desiccate during the growing season. Common to this zone are slender fimbry and flood tolerant shrubs of buttonbush. Carolina bays are often embedded in a matrix of seasonally flooded swamp forests that are dominated by red maple, sweetgum, and persimmon. Many plants and animals considered rare in Maryland are known to occur in Carolina bays.

Location and Condition:

In Maryland, Carolina bays are restricted to the Lower Coastal Plain and are most abundant in Kent, Queen Annes, Caroline, and Dorchester Counties. Although high quality examples of each of these habitats exist, most of these bays suffer from significant abiotic and biotic threats. There are heavy impacts on Carolina bays from suspected lowering ground water,

causing an increase in woody plant invasion and succession of historically herbaceous types to shrub and forested types (Berdine and Gould 1999). It has been estimated that 10,000 acres of palustrine wetlands were lost to agricultural practices between 1955 and 1978 and 2062 acres were lost due to agricultural practices between 1982 and 1989 (Tiner and Burke 1995). The impacts of traditional land use are accompanied by the pressures from land development. The conversion of land from natural cover and agricultural uses to commercial and residential uses poses one of the single largest threats to palustrine wetlands in Maryland.

An ongoing inventory of natural communities by NHP has documented 175 acres of this extremely rare habitat type remaining in Maryland. Approximately 25% of this key wildlife habitat is owned by the state, 25% is owned by conservation organizations (primarily The Nature Conservancy), and 50% is in private ownership.

Figure 4.10 Location of Carolina Bays in Maryland (Sources: USFWS NWI; MD DNR Wetlands; MD DNR NHP)

GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Southeastern star-nosed mole
Birds
Pied-billed grebe
Reptiles
Spotted turtle
Amphibians
Barking treefrog
Carpenter frog
Eastern spadefoot
Eastern tiger salamander

New Jersey chorus frog
Inverts: Dragonflies & Damselflies
Attenuated bluet
Aurora damsel
Azure bluet
Bar-winged skimmer
Blue-faced meadowhawk
Comet darner
Cyrano darner
Fine-lined emerald

Harlequin darner
Slender bluet
Sphagnum sprite
Spotted spreadwing
Sweetflag spreadwing
Taper-tailed darner
Vesper bluet
Rare Natural Communities
Carolina Bays

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink, northern river otter, eastern cottontail, woodchuck, muskrat, wild turkey, northern bobwhite, American woodcock, common snipe, mallard, American black duck, wood duck, blue-winged teal, green-winged teal, ring-necked duck, hooded merganser, American crow, fish crow, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Woody encroachment (buttonbush, red maple, sweetgum, and other species succeeding into formerly open-canopy herbaceous-dominated seasonal wetlands)
j. Exclusion of natural fire regimes that promote conversion of habitat
k. Incompatible silviculture practices that results in habitat degradation

Conservation Actions:

a. Conserve and maintain the integrity of Carolina bay wetland systems, including targeting the highest quality areas for acquisition and working with appropriate planning and zoning agencies ***[Measure: # of priority Carolina bays protected]***

b. Maintain wetland breeding habitat and adjacent upland non-breeding habitats (life zones) of GCN species ***[Measure: # of acres of habitat for GCN species protected]***

c. Protect wetlands through acquisition and easements, including surrounding buffers ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***

d. Restore hydrology through ditch plugging and other appropriate practices ***[Measure: # of Carolina bays with restored hydrology]***

e. Restore wetland conditions where appropriate ***[Measure: # of acres wetlands restored]***

f. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

g. **Incorporate wetland conservation actions into land planning efforts and public land management plans** ***[Measure: # of acres of wetlands conserved during land planning efforts; # of public land management plans incorporating wetland wildlife focused habitat conservation actions]***
h. Limit development impacts within wetland areas and surrounding watershed *[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]*
i. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*
j. Implement prescribed burn programs to control woody vegetation *[Measure: # of acres maintained with controlled burn program]*
k. Identify forest management practices that would improve habitat suitability *[Measure: guidelines developed]*
l. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*
m. Work with watershed groups, watershed based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*
n. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*
o. Develop and implement protocols to control invasive species and prevent their establishment *[Measure: # of protocols developed; # of sites with management implemented]*
p. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*
q. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*
r. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Implement effective assessment of population abundance, trends, distribution, and movement patterns, and for improved monitoring GCN species, especially amphibians and odonates *[Measure: # of surveys completed; # of monitoring programs implemented]*
b. Conduct studies on the factors limiting species abundance, such as predation rates, reproductive success, contamination, and prey availability *[Measure: # of research studies completed; # of research papers published]*
c. Determine landscape attributes and preserve designs that will allow the persistence of populations *[Measure: # of research studies completed; # of research papers published]*
d. Determine management needs and best management practices for GCN species *[Measure: # of research studies completed; # of BMPs developed]*
e. Monitoring programs should accompany management activities to assess effects of techniques on GCN species and long-term habitat suitability *[Measure: # of monitoring programs established; # of monitoring programs conducted]*
f. Determine and monitor hydrologic conditions, including the impacts of irrigation *[Measure: # of hydrologic monitoring sites established; impacts of irrigation determined]*

(11) Vernal Pools

Description:

Vernal pools are small (~0.1-2 ha), nontidal palustrine forested wetlands. They exhibit a well-defined, discrete basin and lack a permanent, above ground outlet. The basin overlies a clay hardpan or some other impermeable soil or rock layer that impedes drainage. As the water table rises in fall and winter, the basin fills, forming a shallow pool. By spring, the pool typically reaches maximum depth (~0.5-2.5 m) following snowmelt and the onset of spring rains. By mid-late summer, the pool usually dries up completely, although some surface water may persist in relatively deep basins, especially in years with above average precipitation. This periodic, seasonal drying prevents fish populations from becoming established, an important biotic feature of vernal pools. Many species have evolved to use these temporary, fish-free wetlands. Some are obligate vernal pools species, so called because they require a vernal pool to complete all or part of their life cycle.

Vernal pools occur throughout the state as scattered, isolated habitats. They are most numerous on the Lower Coastal Plain, especially on the mid- to upper Eastern Shore, and uncommon west of the Fall Line. They are typically situated in low areas or depressions in a forest but they can also occur in floodplain forests as isolated floodwaters, backwaters of old beaver impoundments, old sinkholes, or as perched spring- or seep-fed basins along mountain slope benches or at the base of slopes. Vernal pools may persist in cleared areas such as cropland, pastures and clearcuts but usually in a highly degraded ecological state.

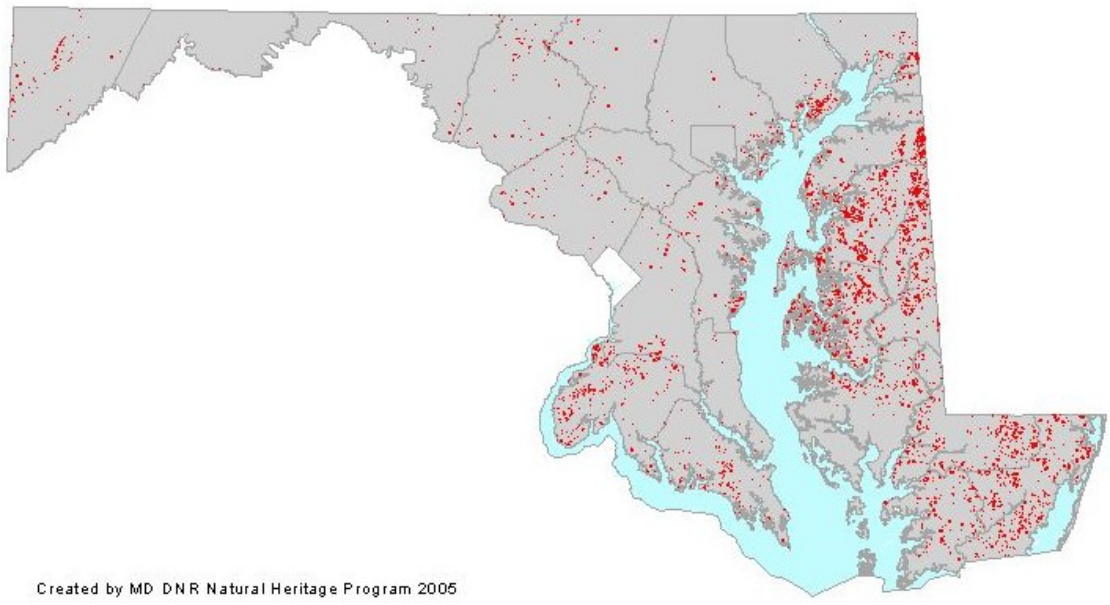
Because vernal pools occur throughout the state in a variety of forest types and settings, the vegetation in and around these habitats varies considerably. However, many vernal pools exhibit similar vegetative structure. For example, pools tend have a semi-open to closed forest canopy and the degree of canopy closure generally decreases with pool size. The basin substrate consists of dense mats of submerged leaf litter and scattered, coarse woody debris. Herbaceous vegetation is usually absent to sparse in and around the basin, although small sphagnum patches may occur along the basin edge. A dense shrub layer may occur along the shoreline or in small patches within the basin, especially on the Coastal Plain, but many pools also lack a well-developed shrub layer.

Location and Condition:

Most of the state's remaining vernal pools occur on the Coastal Plain, with the largest numbers, perhaps several thousand or more, occurring on the mid- and upper Eastern Shore.

Relatively few vernal pools occur west of the Fall Line and perhaps only several hundred occur in the Allegheny Plateau and Ridge and Valley physiographic regions. Vernal pools in these latter regions are also much more scattered and isolated. Information on the number, distribution, and ecological conditions of these relatively small wetland systems is inadequate or lacking for all regions in the state. However, it is likely that a large percentage of the state's vernal pools have been destroyed or degraded by development, agriculture and logging practices.

Figure 4.11 Location of Vernal Pools in Maryland (Sources: USFWS NWI; MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Southeastern star-nosed mole
Amphibians
Carpenter frog
Eastern narrow-mouthed toad
Eastern spadefoot
Jefferson salamander
New Jersey chorus frog
Inverts: Dragonflies & Damselflies
Amber-winged spreadwing
Attenuated bluet

Aurora damsel
Azure bluet
Bar-winged skimmer
Blue-faced meadowhawk
Comet darner
Cyrano darner
Harlequin darner
Lyre-tipped spreadwing
Slender bluet
Sphagnum sprite
Spotted spreadwing

Sweetflag spreadwing
Taper-tailed darner
Vesper bluet
Inverts: Beetles
Seth forest water scavenger beetle
Inverts: Freshwater Crustaceans
An entocytherid ostracod
An entocytherid ostracod
Rare Natural Communities
N/A

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, eastern fox squirrel, red fox, common

gray fox, coyote, common raccoon, Virginia opossum, long-tailed weasel, mink, striped skunk, American woodcock, wood duck, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Recreational activities, such as off-road vehicles, that cause increased human disturbance of habitat
j. Mosquito control practices such as adulticide use and introduction of larvicides or biological control agents such as mosquitofish or mudminnows to control mosquito larva
k. Groundwater contamination from development and agriculture
l. Woody encroachment of formerly open-canopy herbaceous dominated habitat
m. Misidentification of vernal pools by development contractors and consultants

Conservation Actions:

a. Protect wetlands through acquisitions and easements ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***

b. Amend state wetlands laws to protect all GCN vernal pool habitats ***[Measure: # of law and regulation modifications passed]***

c. Limit development impacts within wetland areas and surrounding watershed ***[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]***

d. Ensure that surrounding land uses do not alter hydrological conditions in vernal pools ***[Measure: # of vernal pool focused hydrologic guidelines incorporated into land use and planning efforts]***

e. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

f. Promote BMPs to appropriate public and private land managers, agencies and industries that have the greatest potential to influence protection of vernal pool habitat and buffers ***[Measure: # of BMPs developed and promoted; # of BMPs incorporated into local, state, and federal agency plans and private lands stewardship plans]***

g. **Reduce impacts of mosquito control and gypsy moth control in the vicinity of known vernal pool habitat** ***[Measure: # of sites with vernal pool habitat protected from impacts of development, groundwater withdrawal and pest management]***
h. Delineate habitat boundaries and sensitive management areas for all populations and metapopulations of GCN species *[Measure: # of acres of habitat boundaries and sensitive management areas mapped; # of species with distribution maps updated]*
i. Work with landowners to obtain protection for known vernal pools on private property *[Measure: # of landowners participating in conservation programs; # of sites with vernal pools protected]*
j. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*
k. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*
l. Eliminate human disturbance, such as off-road vehicles, in and around vernal pool habitats *[Measure: # of sites with limited access and educational signage]*
m. Coordinate conservation with federal farm bill programs, DNR, SHA, MDA, and local jurisdictions *[Measure: # of acres conserved through coordination of local, state, and federal agency activities]*
n. Maintain or restore forest connectivity between vernal pool habitats *[Measure: # of sites with vernal pool habitat that have forest corridors maintained or restored]*
o. Create or restore vernal pools *[Measure: # of vernal pools established or restored]*
p. Develop and implement protocols to control invasive species and prevent their establishment *[Measure: # of protocols developed; # of sites with management implemented]*
q. Incorporate wetland conservation actions into land planning efforts and public land management plans *[Measure: # of acres of wetlands conserved during land planning efforts; # of public land management plans incorporating wetland wildlife focused habitat conservation actions]*
r. Coordinate with regulatory agencies to protect vernal pool habitat *[Measure: # of vernal pool sites protected through coordination with regulatory agencies]*
s. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*
t. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*
u. Educate the public about the values of vernal pools and their conservation *[Measure: # of educational materials developed and distributed]*
v. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*
w. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*
x. Coordinate conservation with NE PARC *[Measure: # of cooperative projects implemented]*
y. Reduce sources of groundwater contamination by implementing BMPs for nutrients on agricultural lands *[Measure: # of sites with BMPs implemented for reduction of nutrient contamination]*
z. Work with landowners and the farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*
aa. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Initiate long-term monitoring studies of GCN species, including reptiles, amphibians, and invertebrates *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
c. Conduct research on habitat use and requirements of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
d. Conduct research to determine movement patterns and dispersal of GCN species, especially reptiles amphibians *[Measure: # of research projects conducted; # of research papers published]*
e. Conduct an inventory and characteristics of vernal pool habitat *[Measure: # of surveys completed]*
f. Determine beneficial long-term management needs and practices *[Measure: # of research projects conducted; # of research papers published; # of BMP's developed]*
g. Conduct hydrological studies *[Measure: # of hydrologic monitoring sites established; # of research projects conducted; # of research papers published]*

(12) Forested Seepage Wetlands

Description:

Forested seepage wetlands occur around large seepage areas or springs, along the uppermost reaches of gently sloping headwater streams, and along ravine bottoms and toe slopes. Although present in each physiographic region, these wetlands are scattered, local and uncommon. They occur where groundwater is forced to the surface along an impermeable clay or rock layer due to hydrostatic pressure resulting from gravity or artesian flow. Surface water appears as broad, diffuse zones of wetness, percolation and/or highly braided, small rivulets where soils usually remain saturated during most or all of the year. Soils are typically moderately to strongly acidic and nutrient-poor. Occasionally, circumneutral conditions exist where sites overlie calcareous rock strata. These are predominantly forested wetlands with a mostly closed to semi-open canopy. However, often a mosaic of small shrub and open, sedge- and graminoid-dominated emergent wetland patches are also present. The forest floor is characterized by spaghnum-covered hummocks, dense fern and skunk-cabbage patches, and saturated sand, muck- or peat-filled depressions. On the coastal plain, a red maple-black gum-swamp magnolia forest community is usually dominant. The understory tends be dense with swamp azalea, huckleberries, greenbrier, poison-ivy, and blueberries. West of the Fall Line, red maple and black gum continue to be frequent dominants but various ashes, yellow and black birch, and tulip poplar may be common canopy species as well. Common understory species include spicebush, winterberry, and arrowwood. On the Allegheny Plateau, eastern hemlock and red spruce may be dominant at some sites along with dense rhododendron thickets.

Location and Condition:

Because of the difficulty in remotely mapping this small, mostly closed canopy wetland system, very little information is available on the extent, location and condition of forested seepage wetlands. It is likely, however, that this habitat is most common in the southern Upper Coastal Plain where it often occurs in steep, dissected forested ravine systems. Some of the best known examples of forested seepage wetlands occur in Charles County near Douglas Point. Other high quality examples occur on the Allegheny Plateau in association with high elevation bog wetland complexes and in the Ridge and Valley province as circumneutral seepage wetlands. Much remains to be learned about the status and distribution of this key wildlife habitat in Maryland.

[No location map is available.]

GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Bobcat
Eastern red bat
Hoary bat
Silver-haired bat
Southeastern shrew
Southeastern star-nosed mole
Southern bog lemming
Southern rock vole
Birds
Acadian flycatcher
American redstart
American woodcock
Barred owl
Black-and-white warbler
Black-billed cuckoo
Black-throated blue warbler
Black-throated green warbler
Canada warbler
Hairy woodpecker
Hermit thrush
Hooded warbler
Kentucky warbler
Louisiana waterthrush
Magnolia warbler
Northern waterthrush
Ovenbird
Pileated woodpecker
Red-eyed vireo

Red-shouldered hawk
Scarlet tanager
Veery
Wood thrush
Reptiles
Bog turtle
Common ribbonsnake
Eastern box turtle
Queen snake
Spotted turtle
Amphibians
Allegheny Mountain dusky salamander
Carpenter frog
Eastern mud salamander
Eastern spadefoot
Long-tailed salamander
Mountain chorus frog
New Jersey chorus frog
Northern red salamander
Seal salamander
Inverts: Dragonflies & Damselflies
Arrowhead spiketail
Aurora damsel
Brown spiketail
Delta-spotted spiketail
Eastern red damsel
Elfin skimmer
Fine-lined emerald

Gray petaltail
Sedge sprite
Seepage dancer
Ski-tailed emerald
Sphagnum sprite
Tiger spiketail
Treetop emerald
Yellow-sided skimmer
Inverts: Butterflies & Moths
Baltimore checkerspot
Chermock's mulberry wing
Dion skipper
Indian skipper
Long dash
Pepper and salt skipper
Inverts: Freshwater Crustaceans
An entocytherid ostracod
An entocytherid ostracod
Inverts: Land Snails
Cylindrically-ornate wood snail
Rare Natural Communities
Coastal Plain/Piedmont Acidic Seepage Swamps
High Elevation Seepage Swamps
Mountain/Piedmont Acidic Seepage Swamps
Mountain/Piedmont Basic Seepage Swamps

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, red fox, common gray fox, common raccoon, Virginia opossum, long-tailed weasel, striped skunk, fisher, mink, American beaver, muskrat, American woodcock, , American crow, fish crow, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation

c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Incompatible silviculture practices that results in habitat degradation
j. Nontarget impacts of gypsy moth control
k. Mosquito control practices such as adulticide use and introduction of larvicides or biological control agents such as mosquitofish or mudminnows to control mosquito larva
l. Altered natural disturbance patterns resulting in inadequate habitat conditions for some GCN species
m. Misidentification of seepage wetlands by development contractors and consultants

Conservation Actions:

a. Establish and maintain protected networks of wetland sites and movement corridors within an extensive forest matrix ***[Measure: # of acres wetland/forest matrix and corridors protected]***

b. Establish and maintain effective buffers along wetlands, by restoring natural communities where possible ***[Measure: # of miles wetland buffers established; # of acres of natural communities restored adjacent to wetlands]***

c. Protect wetlands through acquisitions and easements ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***

d. Restore and protect forested seepage wetlands, other associated wetlands and surrounding watersheds ***[Measure: # of acres degraded habitat restored and protected]***

e. Limit development impacts to wetland areas and surrounding watershed ***[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]***

f. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

g. Incorporate wetland conservation actions into land planning efforts and public land management plans ***[Measure: # of acres of wetlands conserved during land use and land planning efforts; # of public land management plans incorporating wetland wildlife focused habitat conservation actions]***

h. Develop habitat management guidelines for use by foresters and land managers and work with them to implement such ***[Measure: habitat management guidelines developed; # of wildlife focused habitat management guidelines incorporated into land use and planning effort]***

i. Work with Maryland DOT to construct roads in such a way that minimizes effects on movement patterns of GCN species, especially for amphibians and reptiles that use these wetlands year-round or seasonally as breeding habitat *[Measure: # or miles of new roads constructed to minimize habitat fragmentation]*

j. Enforce and modify, as needed, nontidal wetland protection regulations especially as it relates to Nontidal Wetlands of Special Concern *[Measure: # of regulation modifications proposed; # of violations prosecuted; # of citations issued]*
k. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*
l. Develop and implement protocols to control invasive species and prevent their establishment *[Measure: # of protocols developed; # of sites with management implemented]*
m. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*
n. Minimize mosquito control and gypsy moth control in forested seepage wetland sites and surrounding landscape *[Measure: # of sites with reduced quantity or frequency of pesticide use]*
o. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*
p. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*
q. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*
r. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*
s. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*
t. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Conduct surveys to better determine the distribution, characteristics and condition of forested seepage wetlands *[Measure: # of surveys completed]*
b. Conduct surveys to better determine the distribution, abundance, population strongholds and status of GCN species, especially odonates, reptiles, amphibians, butterflies, and subterranean/groundwater invertebrates *[Measure: # of surveys completed]*
c. Conduct research on life history, habitat requirements, metapopulation dynamics and movement/dispersal patterns of GCN species *[Measure: # of research projects conducted; # of research papers published]*
d. Determine effective buffer widths as it relates to development, timber harvesting and farming practices; include upland life zone requirements of reptiles and amphibians, foraging requirements of bats, and area-sensitive species (e.g., bobcat) *[Measure: # of research projects conducted; # of research papers published]*
e. Monitor habitat conditions and GCN species, especially those that serve as effective indicator, umbrella or keystone species, and species for which population trend data are most urgently needed *[Measure: # of monitoring studies established; # of monitoring studies conducted]*

(13) Bog and Fen Wetland Complexes

Description:

Bogs and fens are open seepage wetlands supporting a patchwork of saturated shrub and herbaceous vegetation. The term "bog" is actually a technical misnomer, and in strict usage applies only to peatlands that are fed by rainwater (ombrotrophic). We have adopted it here for consistency since this term is so widely used throughout much of the region to describe open, acidic seepage wetlands. In Maryland, bogs and fens are groundwater-fed (minerotrophic) and best developed on seepage slopes, along headwater streams, oxbows of streams, and margins of beaver ponds, established millponds, and sandpits. Bog soils vary from mineral to deep peat, are extremely acidic, nutrient-poor, and often support a variety of sphagnum mosses. Bogs on the Appalachian Plateau are uncommon habitats, often occurring in openings on seepage slopes and along streams bordered by forests of red spruce, eastern hemlock, white pine, larch, red maple, and black gum. Shrubs common to these habitats include speckled alder, narrow-leaved meadowsweet, mountain holly, and black chokeberry. Small openings interspersed amongst the shrub growth support dense mats of sphagnum and haircap mosses and herbaceous species such as Virginia cotton-grass, rose pogonia, round-leaved sundew, and a variety of ferns, rushes, and sedges.

On the Coastal Plain, bogs are rare habitats associated with seepage toeslopes, small stream bottoms, and long-established millponds and sandpits. Bogs locally referred to as "Magnolia bogs" occur at the bases of sand and gravel terraces near streams where groundwater seepage is abundant and forced to the surface by an impermeable clay lens or aquiclude. Unlike true bogs, Magnolia bogs are not characterized by accumulations of peat or organic soils. Nutrient-poor and acidic seepage flows from groundwater, often forming mucky depressions and braided channels around hummocks of sphagnum mosses. Historic accounts of Magnolia bogs describe these areas with sweetbay magnolia and various shrubs fringing and forming clumps within a more open center dominated by herbaceous plants. Today, remaining examples exist mostly as open woodlands of black gum and sweetbay magnolia with very dense shrubs and very small, scattered herbaceous patches. Shrubs common to these habitats include sweetbay magnolia, swamp azalea, highbush blueberry, fetterbush, dangleberry, poison sumac, and possum haw. Herbaceous openings include species such as cinnamon fern, cypress panicgrass, partridge-berry, coastal carrionflower, wild yam, Indian cucumber-root, brownish beaksedge, and primrose-leaved violet. Regionally uncommon or rare "bog" species persisting in Magnolia bogs include bog goldenrod, ten-angled pipewort, Long's rush, spatulate-leaved sundew, red milkweed, and sheep laurel.

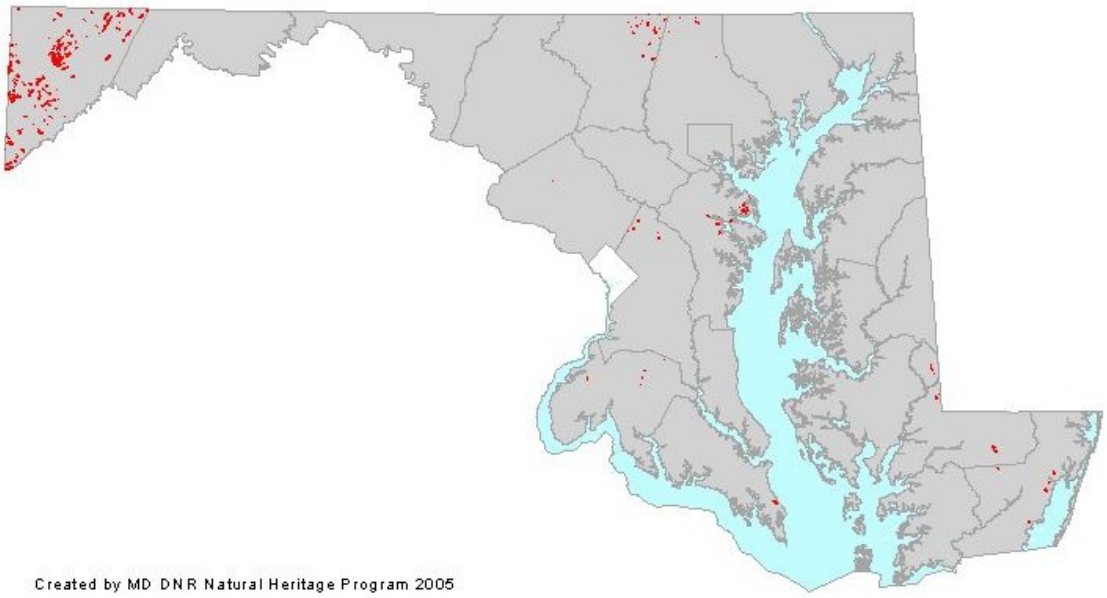
Unlike Magnolia bogs, which are restricted to areas just east of the fall line, similar seepage wetlands occur throughout the Coastal Plain and Piedmont in a variety of settings. In the Coastal Plain, these habitats are differentiated from Magnolia bogs by dense layers of accumulated peat. Openings along the margins of slow-moving streams, millponds, and abandoned sandpits often support patches of such shrub species as large cranberry, sweet pepperbush, swamp loosestrife, and giant cane. Hummocks of sphagnum mosses are characteristic and usually support species such as white beak-rush, rose pogonia, common St. John's-wort, and Virginia meadow-beauty. Orchids, sundews, bladderworts, and yellow-eyed grasses are also common. Similar wetlands in the Piedmont occur over a variety of substrates and have a much different plant composition. Characteristic species may include smooth alder, swamp rose, black willow, skunk-cabbage, spotted jewelweed, tussock sedge, and rice cutgrass. Regionally rare species that may occur in Piedmont seepage wetlands include Canada burnet and brown bog sedge.

Sea-level fens are small, maritime seepage wetlands that occur above the high tide line at the bases of slopes where abundant groundwater discharges along the upper edges of estuarine bays. The hydrology of these sites is best characterized as saturated, although shallow standing water and small, muck-filled pools are locally present at all sites. Soils are characterized as organic and nutrient-poor. The vegetation exhibits characteristics of both inland seepage bogs and slightly brackish tidal marshes. Stands are generally a physiognomic mosaic of open woodland, scrub, and herbaceous patches. Woody species include red maple, black gum, bayberry, and southern bayberry. Characteristic herbs include twig rush, beaked spikerush, white beakrush, spatulate-leaved sundew, ten-angled pipewort, coinleaf, brownfruited rush, and bladderworts.

Location and Condition:

A significant portion of Maryland's bogs and fens have been destroyed or seriously impacted by strip mining, agricultural conversion, lake and pond construction, and development. Although the ecological dynamics of these habitats are not fully understood, many have suffered from shrub and tree succession. Factors that may have been responsible for creating and maintaining these habitats include fire, grazing, beavers, and deep deposition of unstable soils. Bog and fen habitats are most numerous in Garrett County where the best remaining examples are found on property owned and managed by the Nature Conservancy. Bogs and fens throughout the Coastal Plain and Piedmont are rare, concentrated around the Mid-Atlantic fall line zone and Magothy River watershed. Examples also occur throughout the Coastal Plain in managed habitats such as powerline rights-of-way. They have always had a limited distribution in the Mid-Atlantic fall line zone and have probably always been rare. Today, less than 10 sites of this type remain in very small patches degraded by fire exclusion, woody succession, and various anthropogenic impacts. Sea-level fens are extremely rare in Maryland and throughout much of their range. Remnant sea-level fens have been documented in Anne Arundel, Wicomico, and Worcester Counties. Many of these habitats have been severely degraded by tidal flooding associated with ditching and chronic sea-level rise, excessive nutrient input through localized runoff, and invasion of common reed.

Figure 4.13 Location of Bog and Fen Wetland Complexes in Maryland (Sources: USFWS NWI; MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
American marten
Bobcat
Eastern red bat
Hoary bat
Indiana bat
North American Porcupine
Northern flying squirrel
Silver-haired bat
Smoky shrew
Snowshoe hare
Southeastern myotis
Southeastern star-nosed mole
Southern bog lemming
Southern pygmy shrew
Southern water shrew
Birds
Acadian flycatcher
Alder flycatcher
American black duck
American redstart
American woodcock
Barred owl
Black-and-white warbler

Black-billed cuckoo
Blackburnian warbler
Black-throated blue warbler
Black-throated green warbler
Blue-headed vireo
Blue-winged warbler
Broad-winged hawk
Brown creeper
Brown thrasher
Canada warbler
Chestnut-sided warbler
Common raven
Dark-eyed junco
Eastern towhee
Field sparrow
Golden-crowned kinglet
Golden-winged warbler
Hairy woodpecker
Hermit thrush
Hooded warbler
Kentucky warbler
Least flycatcher
Louisiana waterthrush
Magnolia warbler

Mourning warbler
Nashville warbler
Northern parula
Northern saw-whet owl
Northern waterthrush
Olive-sided flycatcher
Ovenbird
Pileated woodpecker
Prairie warbler
Prothonotary warbler
Red-breasted nuthatch
Red-eyed vireo
Red-shouldered hawk
Scarlet tanager
Sedge wren
Sharp-shinned hawk
Swainson's thrush
Veery
Willow flycatcher
Winter wren
Wood thrush
Worm-eating warbler
Yellow-bellied sapsucker
Yellow-throated vireo

Reptiles
Bog turtle
Common ribbonsnake
Eastern box turtle
Mountain earthsnake
Northern coal skink
Queen snake
Spotted turtle
Amphibians
Allegheny Mountain dusky salamander
Eastern mud salamander
Mountain chorus frog
New Jersey chorus frog
Seal salamander
Inverts: Dragonflies & Damselflies
Amber-winged spreadwing
American emerald
Atlantic bluet
Attenuated bluet
Aurora damsel
Azure bluet
Band-winged meadowhawk
Bar-winged skimmer
Beaverpond baskettail
Black-tipped darner
Blue-faced meadowhawk
Canada darner
Chalk-fronted skimmer
Cherry-faced meadowhawk
Comet darner

Crimson-ringed whiteface
Cyrano darner
Dot-tailed whiteface
Eastern red damsel
Elfin skimmer
Fine-lined emerald
Golden-winged skimmer
Green-striped darner
Hagen's bluet
Harlequin darner
Hudsonian whiteface
Lance-tipped darner
Little blue dragonlet
Lyre-tipped spreadwing
Mantled baskettail
Petite emerald
Rainbow bluet
Sedge sprite
Seepage dancer
Ski-tailed emerald
Slender bluet
Southern sprite
Sphagnum sprite
Spotted spreadwing
Spring blue darner
Stripe-winged baskettail
Sweetflag spreadwing
Taper-tailed darner
Treetop emerald
Tule bluet
Vesper bluet

White corporal
White-faced meadowhawk
Yellow-sided skimmer
Inverts: Butterflies & Moths
A noctuid moth
Atlantis fritillary
Baltimore checkerspot
Bog copper
Dion skipper
Harris's checkerspot
Hessel's hairstreak
Long dash
Mitchell's satyr
Pepper and salt skipper
Pink-edged sulphur
Silver-bordered fritillary
Two-spotted skipper
Inverts: Dipterans
Pitcher-plant mosquito
Inverts: Land Snails
Spruce knob threetooth
Striped whitelip
Rare Natural Communities
Atlantic White Cedar Wetlands
Appalachian Bogs/Fens
Coastal Plain Acidic Seepage Bogs/Fens
Interdunal Swales
Sea-level Fens

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, red squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, fisher, mink, northern river otter, eastern cottontail, woodchuck, American beaver, muskrat, American woodcock, common snipe, sora, Canada goose, mallard, American black duck, wood duck, ring-necked duck, hooded merganser, American crow, fish crow, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat

b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Acid mine drainage
j. Incompatible silviculture practices that results in habitat degradation
k. In Allegheny Plateau, timber harvesting that results in loss of northern conifers (red spruce, eastern white pine, balsam fir, eastern hemlock)
l. Decline of Atlantic white-cedar in the Coastal Plain
m. Hemlock wooly adelgid that causes loss of eastern hemlock component
n. High deer densities resulting in overbrowsing
o. Habitat degradation by ORV's and other human disturbances
p. Altered natural disturbance patterns or lack of certain management practices
q. Acid precipitation that results in habitat degradation
r. Nontarget impacts of gypsy moth control.
s. Increase in nutrients as a result of septic and stormwater runoff
t. Lack of adequate buffers in development areas
u. Sea-level rise and increased erosion rates that result in loss of habitat and increased flooding events

Conservation Actions:

a. Establish and maintain protected networks of bog-fen wetland sites and provide sufficient landscape connectivity within an extensive forest matrix ***[Measure: # of acres wetland/forest matrix and corridors protected]***

b. Avoid or minimize timber harvesting impacts in wetland areas and surrounding forest matrix ***[Measure: # of wetland wildlife focused habitat management guidelines incorporated into silviculture plans]***

c. Protect wetlands through acquisitions and easements ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***

d. Incorporate wetland conservation actions into land planning efforts and public land management plans ***[Measure: # of acres of wetlands conserved during land use and land planning efforts; # of public land management plans incorporating wetland wildlife focused habitat conservation actions]***

e. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

f. Work with farming community to restore and protect wetlands ***[Measure: # of sites with cooperative management projects; # of acres wetlands restored and protected]***

g. Develop and implement protocols to control invasive species and prevent their establishment ***[Measure: # of protocols developed; # of sites with management implemented]***

h. **Enforce and improve, as needed, nontidal wetland protection regulations especially as it relates to Nontidal Wetlands of Special Concern** ***[Measure: # of regulation modifications proposed; # of violations prosecuted; # of citations issued]***

i. Restore northern conifer component of bog-fen wetland complexes on Allegheny Plateau and Atlantic white-cedar component on Coastal Plain, including working with TNC to accomplish such *[Measure: # of acres restored]*

j. Prohibit ORV's in and around wetland sites *[Measure: # of sites with limited access and educational signage]*

k. Limit development impacts within wetland areas and surrounding watershed *[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]*

l. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*

m. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*

n. Manage or control livestock grazing within the wetlands *[Measure: # of sites with livestock grazing impacts reduced or eliminated]*

o. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*

p. Restore wetlands affected by acid mine drainage *[Measure: # of acres restored]*

q. Educate the public to reduce impacts and disturbances to wetlands *[Measure: # of educational materials developed and distributed]*

r. Implement nitrogen and phosphorus reduction strategies for septic and stormwater runoff *[Measure: # of sites with nutrient reduction strategies implemented]*

s. Develop and implement protocols to control deer populations to reduce browsing levels *[Measure: protocols developed; # of sites or acres with management implemented]*

t. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*

u. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*

v. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*

w. Implement controlled burn programs as appropriate *[Measure: # of acres maintained with controlled burn program; # of sites with natural fire regimes allowed]*

x. Avoid gypsy moth control in wetland areas and surrounding forest matrix *[Measure: # of sites with reduced quantity or frequency of pesticide use]*

y. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*

z. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Initiate long-term monitoring studies of GCN species, including reptiles and amphibians *[Measure: # of monitoring studies established; # of monitoring studies conducted]*

b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*

c. Conduct research on habitat use and requirements of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
d. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*
e. Conduct surveys to better determine the distribution, abundance, population strongholds, and status of GCN species, especially odonates, butterflies, bats, other small mammals (e.g., southern water shrew, southern bog lemming), birds, reptiles, and amphibians *[Measure: # of surveys completed]*
f. Determine effective buffer widths as it relates to development, timber harvesting and farming practices; include upland life zone requirements of reptiles and amphibians, foraging areas for bats, and area-sensitive species like forest-nesting birds and bobcat *[Measure: # of research projects conducted; # of research papers published]*
g. Monitor habitat conditions and GCN species, especially those that serve as effective indicator, umbrella or keystone species, and species for which population trend data are most urgently needed *[Measure: # of monitoring studies established; # of monitoring studies conducted]*

(14) Nontidal Shrub Wetlands

Description:

Nontidal shrub wetlands are inland freshwater wetlands dominated by shrubs and small trees (< 8 m tall). They usually exist as small patch plant communities (< 10 ha) or as transitional or ecotonal habitats within larger freshwater wetland systems. On Maryland's coastal plain, this habitat occurs in seasonally to semi-permanently flooded depressional wetlands such as Delmarva bays (also referred to as coastal plain ponds) and vernal pools. It also occurs in beaver impoundments, along shorelines of millponds and farm ponds, and as scattered patches in floodplain forest openings created by windthrow, floods and beavers. Common dominants include buttonbush, silky dogwood, southern arrowwood, highbush blueberry, and/or smooth alder mixed with small deciduous trees such as red maple, black gum, sweetbay magnolia, black willow, and green ash. On the western shore in Anne Arundel and Prince George's Counties, nontidal shrub wetlands occur within unique seepage wetland complexes often referred to as "magnolia bogs". There, the dominant shrubs include sweetbay magnolia, swamp azalea, highbush blueberry, fetterbush, dangleberry, poison sumac, and possum haw.. Nontidal shrub wetlands on Assateague Island and in coastal areas along the Chesapeake Bay are dominated by wax myrtle and high-tide bushhigh-tide bush tree. These shrublands exist in interdunal depressions characterized by perched water tables and intermittent to seasonal flooding with occasional salt intrusion resulting from storm surges.

In the Piedmont and Ridge and Valley Provinces, nontidal shrub wetlands occur in a number of settings, including wet meadows, beaver impoundments, seepage swamps and floodplain forest openings. The dominant species include buttonbush, spicebush, smooth alder, black willow, silky dogwood, common elderberry, and multiflora rose, an introduced species. Seepage swamps are primarily a forested wetland type occurring along braided headwater streams, large spring seeps and ravine bottoms underlain by sandstone, quartzite or base-poor granite. They are usually dominated by red maple and black gum but sometimes include a shrub wetland component comprised of smooth alder, spicebush and winterberry. Where these habitats have been cleared for pasture, wet meadows form which often retain some form of shrub wetland.

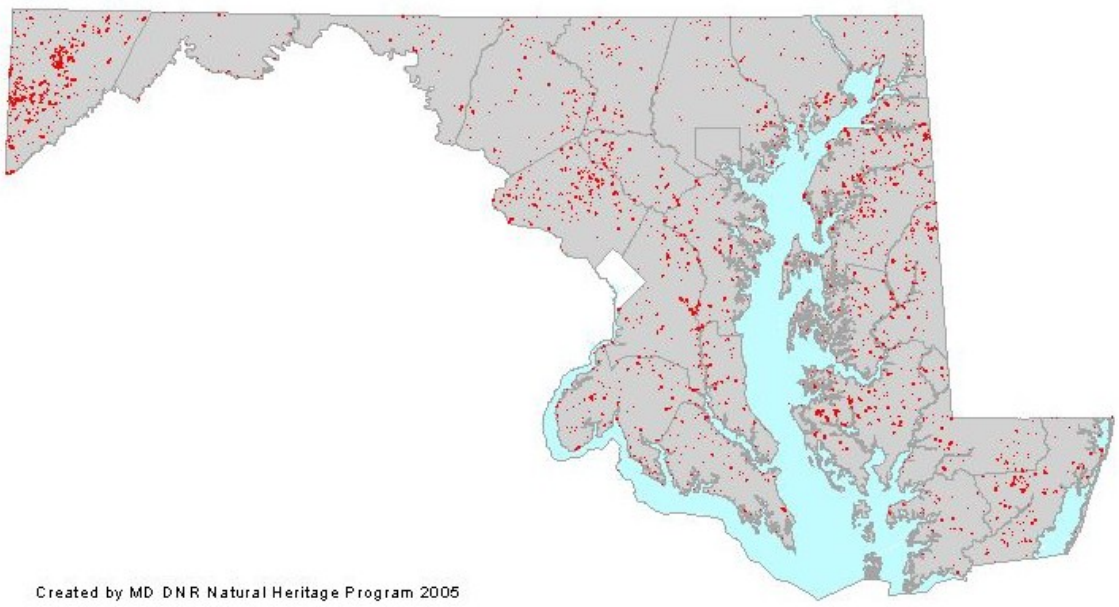
Shrub wetlands on the Allegheny Plateau typically occur within a variety of larger wetland complexes such as high elevation "bogs", fens, seepage wetlands and beaver impounded streams. These areas usually include one or more types of forested and/or emergent

wetlands. A variety of species may be dominant in the shrub wetlands including smooth alder, speckled alder, northern arrowwood, smooth winterberry, black chokeberry, red chokeberry, and mountain holly. Other shrub species potentially present are broad-leaved meadowsweet, narrow-leaved meadowsweet, common elderberry, and great-laurel. Diverse herb layer may be scattered within the shrub wetlands. Wetlands that have been converted to pasture or cleared by strip mining are usually dominated by dense thickets of alder or silky cornel.

Location and Condition:

At present, approximately 15,000 acres of nontidal shrub wetlands occur in the state. This habitat type occurs in every physiographic region, usually as scattered, small (< 10 ha) wetlands. The greatest acreage and many of the state's best examples occur in high elevation bog wetland systems on the Allegheny Plateau. Other examples can be found in Carolina Bays, floodplain forests and along millponds and farm ponds. Many areas have been destroyed or degraded due to conversion to cropland and pasture, as well as to hydrological changes resulting from development and groundwater withdrawal. In many parts of the state, especially along headwater streams, beavers continue to play an important role in creating and maintaining nontidal shrub wetlands.

Figure 4.14 Location of Nontidal Shrub Wetlands in Maryland (Sources: USFWS NWI)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals	American woodcock	Great egret
Bobcat	Black-crowned night-heron	Marsh wren
Southeastern star-nosed mole	Blue-winged warbler	Northern waterthrush
Birds	Chestnut-sided warbler	Prothonotary warbler
Alder flycatcher	Golden-winged warbler	Red-shouldered hawk
American black duck	Great blue heron	Willow flycatcher

Yellow-crowned night-heron
Reptiles
Bog turtle
Common ribbonsnake
Northern red-bellied turtle
Queen snake
Rainbow snake
Spotted turtle
Amphibians

Carpenter frog
Eastern spadefoot
New Jersey chorus frog
Inverts: Butterflies & Moths
Baltimore checkerspot
Dion skipper
Great purple hairstreak
Long dash
Palamedes swallowtail

Rare Natural Communities
Appalachian Bogs/Fens
Coastal Plain Acidic Seepage Bogs/Fens
Sea-level Fens
Maritime Shrub Swamps

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, sika deer, black bear, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, fisher, mink, northern river otter, eastern cottontail, muskrat, American woodcock, mallard, American black duck, wood duck, blue-winged teal, green-winged teal, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Incompatible silviculture practices that results in habitat degradation
j. Acid mine drainage
k. Altered natural disturbance patterns resulting in inadequate habitat conditions for some GCN species
l. Mosquito control practices such as adulticide use and introduction of larvicides or biological control agents such as mosquitofish or mudminnows to control mosquito larva

Conservation Actions:

a. Establish and maintain protected networks of nontidal shrub wetland sites, adjacent wetland types and movement corridors within an extensive forest matrix ***[Measure: # of acres wetland/forest matrix and corridors protected]***

b. Establish and maintain effective buffers along wetlands, by restoring natural communities where possible ***[Measure: # of miles wetland buffers established; # of acres of natural communities restored adjacent to wetlands]***

c. Protect wetlands through acquisitions and easements ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***

d. Limit development impacts within wetland areas and surrounding watershed ***[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]***

e. Incorporate wetland conservation actions into land planning efforts and public lands management plans ***[Measure: # of acres of wetlands conserved during land use and land planning efforts; # of public lands management plans incorporating wetland wildlife focused habitat conservation actions]***

f. Enforce and modify, as needed, nontidal wetland protection regulations especially as it relates to Nontidal Wetlands of Special Concern ***[Measure: # of regulation modifications proposed; # of violations prosecuted; # of citations issued]***

g. Work with farming community to restore and protect wetlands ***[Measure: # of sites with cooperative management projects; # of acres wetlands restored and protected]***

h. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

i. Work with Maryland DOT to construct roads in such a way that minimizes effects on movement patterns of GNC species *[Measure: # or miles of new roads constructed to minimize habitat fragmentation]*

j. Manage beaver populations to create and expand nontidal shrub wetlands where appropriate *[Measure: # of beaver populations managed]*

k. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*

l. Develop and implement protocols to control invasive species and prevent their establishment *[Measure: # of protocols developed; # of sites with management implemented]*

m. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*

n. Minimize mosquito control in nontidal shrub wetland sites *[Measure: # of sites with reduced quantity or frequency of pesticide use]*

o. Restore and protect nontidal shrub wetlands, other associated wetlands and surrounding watersheds *[Measure: # of acres restored and protected]*

p. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*

q. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*

r. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*

s. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*

t. Restore wetlands affected by acid mine drainage *[Measure: # of acres restored]*

u. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*

v. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Conduct surveys to better determine the distribution, abundance, population strongholds and status of GCN species, especially reptiles and amphibians, breeding sites for American woodcock and songbirds, and butterflies *[Measure: # of surveys conducted]*
b. Conduct research on life history, habitat requirements, metapopulation dynamics and movement/dispersal patterns of GCN species *[Measure: # of research projects conducted; # of research papers published]*
c. Determine effective buffer widths as it relates to development, timber harvesting and farming practices; include upland life zone requirements of reptiles and amphibians, area-sensitive species (e.g., bobcat), and foraging areas (e.g., American woodcock) *[Measure: # of research projects conducted; # of research papers published]*
d. Monitor habitat conditions and GCN species, especially those that serve as effective indicator, umbrella or keystone species, and species for which population trend data are most urgently needed *[Measure: # of monitoring programs conducted]*

(15) Tidal Shrub Wetlands

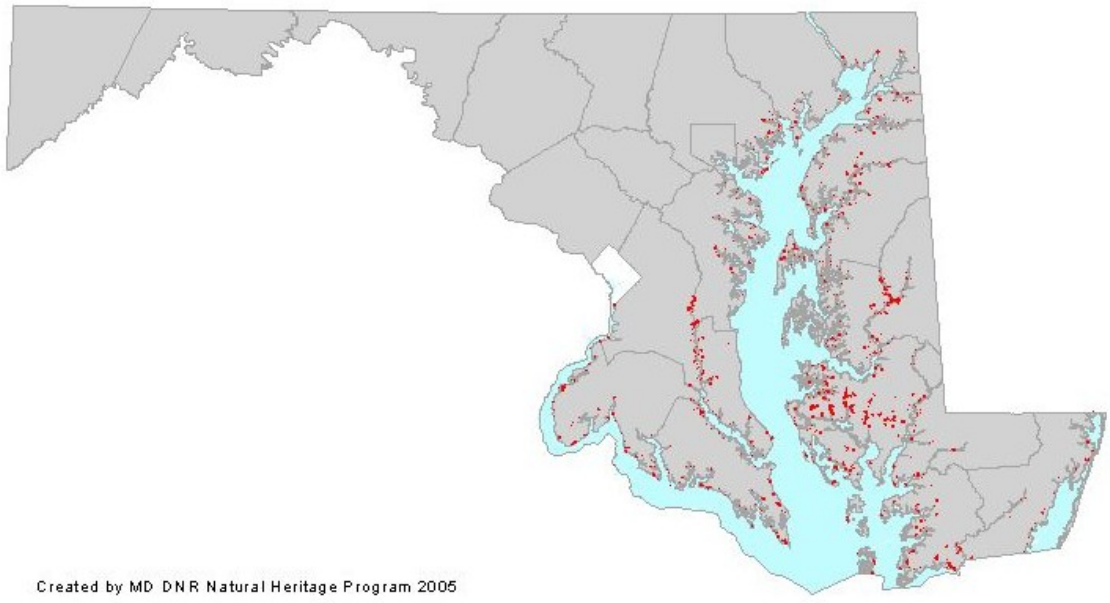
Description:

In Maryland, tidal shrub wetlands are shrub-dominated transitional habitats of freshwater and brackish systems. In freshwater portions of tidal rivers they commonly form small, linear patches on floodplains between tidal emergent marshes and tidal swamp forests. On narrow or constricted floodplains, discrete shrub-dominated communities occur along ecotones or transitional areas and may not be physiognomically distinct. Stands occupying rather expansive marshes or large estuary meanders on broader floodplains are commonly fronted or surrounded by emergent marshes forming depositional islands. Slightly elevated and distanced from tidal influence, these communities tend to be less frequently flooded. The vegetation of tidal freshwater shrub wetlands is very diverse and typically contains species characteristic of both tidal marshes and swamp forests. Shrubs such as smooth alder, winterberry, swamp rose, northern arrow-wood, and silky dogwood are common. Pronounced hummock and hollow microtopography is characteristic and contributes to relatively high species richness with most species confined to irregularly flooded hummocks. Hollows are regularly flooded and typically contain only those species tolerant of frequent inundation. Much like the marshes in brackish systems, "salt scrub" wetlands are generally species poor and composed only of plants tolerant of high salinity such as southern bayberry, high-tide bush, and marsh-elder. These communities are found in saline environments throughout the Lower Coastal Plain. Although salt scrub does occur in tidal habitats, it more commonly occupies higher, only irregularly flooded landscape positions in a mosaic with lower, regularly flooded salt marsh. Salt scrub stands often occur in maritime environments, where they are influenced especially by high winds and salt spray.

Location and Condition:

Tidal shrubland habitats are found in every county on the Coastal Plain. They account for approximately 1.0% (2,490 acres) of estuarine wetlands and 4.4% (14,963 acres) of palustrine wetlands in Maryland (Tiner and Burke 1995). Although typically small and discrete, habitats of freshwater systems are intact and well buffered by surrounding marsh and swamp forest habitats. Many tidal shrublands of brackish systems have been hydrologically altered by ditching and are susceptible to invasion of common reed. In addition, the ecological dynamics of these habitats are poorly understood.

Figure 4.15 Location of Tidal Shrub Wetlands in Maryland (Sources: USFWS NWI)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Bobcat
Birds
American black duck
Black-crowned night-heron
Boat-tailed grackle
Brown pelican
Coastal Plain swamp sparrow
Glossy ibis
Great blue heron

Great egret
Least bittern
Little blue heron
Marsh wren
Prothonotary warbler
Snowy egret
Tricolored heron
Willow flycatcher
Yellow-crowned night-heron
Reptiles

Northern red-bellied turtle
Rainbow snake
Red-bellied watersnake
Inverts: Butterflies & Moths
Rare skipper
Rare Natural Communities
N/A

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, sika deer, red fox, common gray fox, coyote, common raccoon, Virginia opossum, long-tailed weasel, mink, striped skunk, northern river otter, eastern cottontail, muskrat, northern bobwhite, American woodcock, mallard, American black duck, wood duck, blue-winged teal, green-winged teal, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials (e.g., pesticides, herbicides, other pollutants, nutrient loading from domestic sewage, urban runoff, agricultural runoff, and

sediments from dredging and filling projects, agricultural lands, and other land development) into waters and wetlands, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3) Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses (e.g., water supply, industry, and agriculture), 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of "natural" forested wetlands to pine siliviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea-level rise, storm events, erosion, and mechanical damage by wildlife (e.g., muskrats, mute swans, snow geese, Canada geese) could also have severe impacts on wetlands systems.

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Loss of habitat and increased flooding events due to sea-level rise, subduction, channalization, and increased erosion rates
j. Hardening of shoreline

Conservation Actions:

a. Initiate coordinated efforts to conserve habitat and maintain the integrity of wetland systems across wide geographic areas, including targeting the highest quality areas ***[Measure: # of acres of high quality tidal shrub wetlands targeted and conserved]***

b. Utilize U.S. Army Corp of Engineers, MDE, and Critical Area regulatory processes to protect habitat ***[Measure: # of acres of habitat protected via wetlands regulatory processes]***

c. Limit development impacts within wetland areas and surrounding watershed ***[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]***

d. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

e. Protect wetlands through acquisitions and easements *[Measure: # of acres of wetlands newly protected through acquisitions and easements]*
f. Implement BMPs and adaptive management methods *[Measure: # of sites with BMPs incorporated into management with evaluation of effectiveness]*
g. Restore and enhance breeding and nonbreeding habitats of high priority GCN species *[Measure: # of acres of habitat restored and enhanced]*
h. Develop and implement protocols to control invasive species and prevent their establishment *[Measure: # of protocols developed; # of sites with management implemented]*
i. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*
j. Incorporate wetland conservation actions into land use and land planning efforts *[Measure: # of acres of wetlands conserved during land use and land planning efforts]*
k. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*
l. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*
m. Incorporate wetland conservation actions into public land management plans *[Measure: # of local, state, and federal agency plans incorporating wetland wildlife focused habitat conservation actions]*
n. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*
o. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*
p. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*
q. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*
r. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Research the impact of fire/burning *[Measure: # of research projects conducted; # of research papers published]*
b. Research the successional processes *[Measure: # of research projects conducted; # of research papers published]*
c. Monitor and assess the impact of phragmites control on GCN species *[Measure: # of research projects conducted; # of research papers published]*
d. Develop regional, standardized methodologies for effective assessment of population abundance, trends, distribution, and movement patterns, and for improved monitoring of Maryland populations *[Measure: # of standardized methodologies developed]*
e. Conduct studies on the factors limiting species abundance, such as predation rates, reproductive success, contamination, and prey availability *[Measure: # of research projects conducted; # of research papers published]*
f. Determine precise habitat characterizations and needs, including area sensitivity, habitat quality, and habitat availability *[Measure: # of research projects conducted; # of research papers published]*
g. Determine management needs and best management practices for populations, especially effects of various habitat management practices on species' productivity and on long-term habitat suitability *[Measure: # of research projects conducted; # of research papers published; # of BMP's developed]*

h. Monitoring programs should accompany management activities to assess effects of techniques on GCN species and long-term habitat suitability *[Measure: # of monitoring programs conducted; # of conservation actions modified and re-prioritized based on evaluation of effectiveness]*

(16) Nontidal Emergent Wetlands

Description:

Nontidal emergent wetlands are inland freshwater wetlands dominated by herbaceous vegetation. Unlike tidal fresh marshes (see description under Tidal Marshes), which can encompass large areas (> 100 ha), most nontidal emergent wetlands are small (< 10 ha), frequently occurring as small patches within nontidal forest, shrub and emergent wetland complexes. Across the state, their composition and hydrology vary greatly. On the coastal plain, nontidal emergent wetlands frequently occur in Carolina bays where they dominate the center of these seasonally to semi-permanently flooded depressional wetlands. Common dominants include Walter's sedge, twig rush, giant beardgrass, maidencane, warty panic grass, and mild water-pepper. Emergent wetlands also occur within coastal plain seepage bogs. These acidic wetlands are associated with oligotrophic spring-heads, toe slope seepage areas and small, braided headwater streams. The vegetation is typically a mosaic of shrubs, sphagnum and graminoid-dominated herbaceous vegetation. On Assateague Island, nontidal emergent wetlands occur as interdunal swales. These seasonally to semi-permanently flooded wetlands are situated in interdunal depressions where the water table is perched. Although saltwater occasionally enters the swales during storm surges, it is diluted by precipitation and ground water to the point that freshwater or at least oligohaline (< 0.5 ppt) conditions are maintained. Common dominants include three-square, spikerushes, rushes, switch grass, and spatulate-leaved sundew.

West of the Fall Line, seasonally flooded meadows are the most common type of emergent wetland. Common plant species include cattails, soft rush, rice cutgrass, tussock sedge, halbeard-leaved tearthumb, sweetflag, and skunk-cabbage. Most of these wetlands have been highly altered by forest clearing, farming and high nutrient input. Some were former floodplain forests or old oxbows and sloughs along stream and river valleys. Others represent degraded seepage wetlands. It is likely that, prior to disturbance, most of these wetlands were less open, occurring as predominantly forested wetlands or forest-shrub-emergent wetland complexes. Where these wetlands still exist in a relatively undisturbed state, small graminoid-dominated emergent wetlands may be present.

Nontidal emergent wetlands also occur along the Potomac River and other large Piedmont and montane rivers. These wetlands are situated in sloughs, old oxbows and other floodplain forest openings where lizard's tail, water-willow, and smartweed are common. An uncommon wetland type unique to the Ridge and Valley are sinkhole wetlands, some of

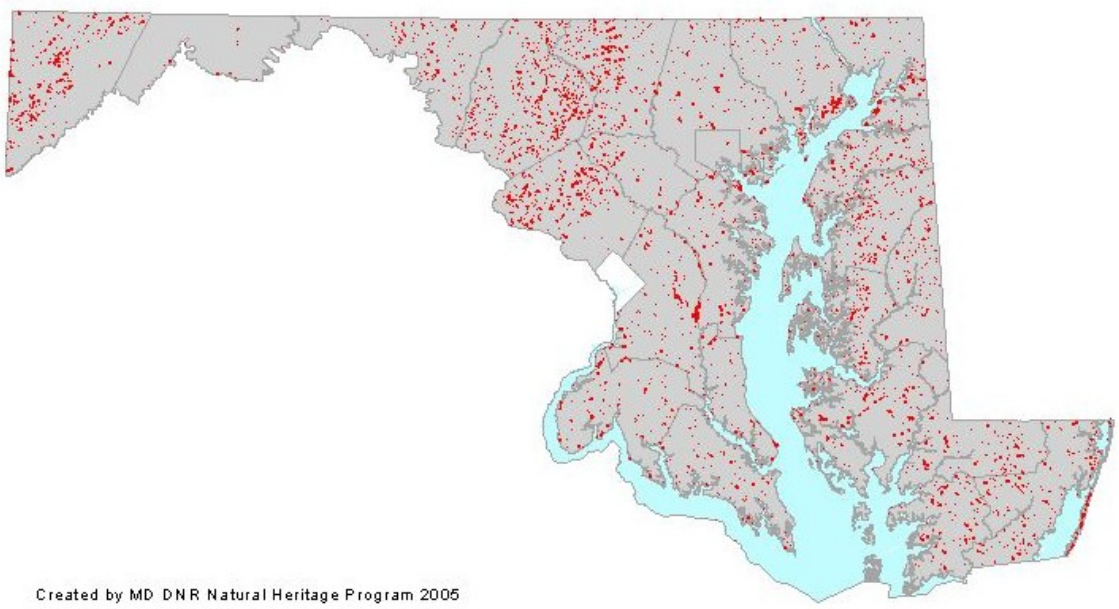
which contain small emergent wetlands. Common emergent plant species include three-way sedge, manna grasses, and sallow sedge. A variety of emergent wetlands, some quite large, also occur in Allegheny Plateau "bogs". Vegetation can be quite diverse and it varies considerably depending on site conditions. Some of the more dominant plants are soft rush, spike-rushes, goldenrods, Virginia cottongrass, various sedges, white beak-rush, and sphagnum mosses.

Across the state, this habitat occurs in a variety of other natural and man-made settings including beaver impounded stream valleys, as scattered patches in floodplain forest openings created by windthrow, floods and beavers; the shorelines of millponds and farm ponds; and moist soil impoundments (cropland converted to seasonally and semi-permanently flooded emergent wetlands). The vegetation in these wetlands varies widely depending on the region, wetland hydrology, depth, size, substrate and other conditions.

Location and Condition:

Over 18,000 acres of nontidal emergent wetlands remain in Maryland. It occurs statewide in a variety of ecological settings from interdunal swales on Assateague Island to spring-fed meadows in the Piedmont. As with nontidal shrub wetlands, this habitat usually occurs as scattered, small (< 10 ha) wetlands and the greatest acreage and many of the state's best examples occur in high elevation bog wetland systems on the Allegheny Plateau. Other examples can be found along Piedmont and montane rivers, in floodplain forest openings and along millponds and beaver impoundments. Many areas have been destroyed or degraded due to conversion to cropland and pasture, and hydrological changes due to development and groundwater withdrawal. Invasive plant species are also a significant threat. In many areas, especially along headwater streams, beavers continue to play an important role in creating and maintaining nontidal emergent wetlands.

Figure 4.16 Location of Nontidal Emergent Wetlands in Maryland (Sources: USFWS NWI)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Bobcat
Least shrew
Southern bog lemming
Birds
American bittern
American black duck
American woodcock
Bald eagle
Black rail
Black tern
Black-bellied plover
Black-crowned night-heron
Common moorhen
Dunlin
Eastern meadowlark
Great blue heron
Great egret
Greater yellowlegs
King rail
Least bittern
Little blue heron
Marsh wren
Northern harrier
Pied-billed grebe

Sedge wren
Semipalmated sandpiper
Short-billed Dowitcher
Snowy egret
Solitary sandpiper
Wilson's snipe
Yellow-crowned night-heron
Reptiles
Bog turtle
Common ribbonsnake
Eastern box turtle
Northern red-bellied turtle
Queen snake
Spotted turtle
Amphibians
Carpenter frog
Eastern spadefoot
New Jersey chorus frog
Inverts: Dragonflies & Damselflies
Band-winged meadowhawk
Eastern red damsel
Elfin skimmer
Faded pennant
Fine-lined emerald

Four-spotted pennant
Green-striped darner
Hagen's bluet
Lance-tipped darner
Little blue dragonlet
Marsh bluet
Martha's pennant
Sedge sprite
White-faced meadowhawk
Inverts: Butterflies & Moths
A noctuid moth
Atlantis fritillary
Baltimore checkerspot
Dion skipper
Harris's checkerspot
Long dash
Mitchell's satyr
Silver-bordered fritillary
Tawny crescent
Two-spotted skipper
Inverts: Homopterans
A cicadellid leafhopper
Inverts: Freshwater Crustaceans
A cyclopoid copepod

Inverts: Land Snails
Striped whitelip
Rare Natural Communities

Appalachian Bogs/Fens
Coastal Plain Acidic Seepage Bogs/Fens
Interdunal Swales

Mountain/Piedmont Acidic Seepage Swamps
Sea-level Fens

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink, northern river otter, eastern cottontail, woodchuck, American beaver, muskrat, American woodcock, common snipe, Virginia rail, king rail, sora, Canada goose, mallard, American black duck, wood duck, gadwall, blue-winged teal, green-winged teal, northern pintail, American widgeon, northern shoveler, ring-necked duck, hooded merganser, American crow, fish crow, and eastern snapping turtle. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Succession and woody vegetation invasion
j. Channelization and damming of streams feeding wetlands
k. Eutrophication or excessive nutrient loading due to agriculture runoff, chemical lawn treatments, and failing septic systems
l. Sedimentation and siltation within the wetlands
m. Conversion to impoundments

Conservation Actions:

a. Encourage acquisition of buffers to protect large complexes of wetlands from development ***[Measure: # of miles buffers protected]***

b. Protect wetlands from contamination, siltation, and eutrophication. (improve stormwater management practices and emergent control measures) ***[Measure: # of acres protected from contamination, siltation and eutrophication]***

c. Encourage beneficial agricultural practices (farm bill programs and other landowner incentives), involvement in Conservation Reserve programs, and the

development of incentives for the maintenance of wetland habitat ***[Measure: # of sites with cooperative management projects; # of acres wetlands protected]***

d. Protect wetlands through acquisitions and easements ***[Measure: # of acres of wetlands newly protected through acquisitions and easements]***

e. Establish and maintain adequate buffers of upland habitat around wetlands ***[Measure: # of miles buffer established]***

f. Incorporate wetland conservation actions into land planning efforts and public land management plans ***[Measure: # of acres of wetlands conserved during land use and land planning efforts;*** *# of public land management plans incorporating wetland wildlife focused habitat conservation actions**]***

g. Work with landowners to encourage retention of emergent wetlands (e.g. DO NOT impound) ***[Measure: # of sites with cooperative management projects]***

h. Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***

i. Develop and implement protocols to control invasive species and prevent their establishment ***[Measure: # of protocols developed; # of sites with management implemented]***

j. Encourage the maintenance of forested habitat adjacent to open-canopy aquatic habitat *[Measure: # of miles adjacent forested habitat protected]*

k. Conduct watershed-level stream restoration and protection efforts (e.g. water source) *[Measure: # of miles streams restored and protected]*

l. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*

m. Limit development impacts within wetland areas and surrounding watershed *[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]*

n. Incorporate wetland conservation actions into public land management plans *[Measure:]*

o. Consider making minor alterations of existing management schemes on wetlands managed for waterfowl by state and federal agencies to improve habitat for GCN species *[Measure: # of management alterations proposed for wetlands managed by public agencies; # of sites where new management adjustments implemented]*

p. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*

q. Establish and maintain habitat linkages between wetlands *[Measure: # of wetlands connected by new habitat linkages]*

r. Restore prior converted and other degraded wetlands *[Measure: # of acres restored]*

s. Limit the use of non-native fish as BMPs for mosquito control and vegetation management *[Measure: # of sites with alternative or control methods using native species implemented]*

t. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*

u. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*

v. Restore wetlands where appropriate *[Measure: # of acres wetlands restored]*

w. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*

x. Promote the establishment and growth of floating-leaved and submerged vegetation *[Measure: # of sites or acres with floating and submerged vegetation management implemented]*

y. Restore semi-permanent and permanent open water habitats and flats within wetlands where appropriate *[Measure: # of sites with restored open water habitats and flats]*

z. Ensure adequate buffer in spraying of habitat for Gypsy Moth and other insect control *[Measure: # of sites with targeted pesticide use with adequate buffers]*

aa. Implement prescribed burn programs to control woody vegetation within the wetlands *[Measure: # of acres maintained with controlled burn program; # of sites with natural fire regimes allowed]*

bb. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*

cc. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Initiate long-term monitoring studies of GCN species *[Measure: # of monitoring studies established; # of monitoring studies conducted]*

b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species *[Measure: # of research projects conducted; # of research papers published]*

c. Conduct research on habitat use and requirements of GCN species *[Measure: # of research projects conducted; # of research papers published]*

d. Conduct species surveys and determine distribution and abundance of GCN species *[Measure: # of surveys completed]*

e. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*

f. Evaluate the effects of the invasion of phragmites and purple loosestrife and other invasives on GCN species *[Measure: # of research projects conducted; # of research papers published]*

g. Determine the effects of development activities on GCN species *[Measure: # of research projects conducted; # of research papers published]*

h. Determine the effects of environmental contaminants on GCN species *[Measure: # of research projects conducted; # of research papers published]*

i. Determine the ranges/current distribution of Gambusia *[Measure: # of surveys completed]*

(17) Tidal Marshes

Description:

Tidal marshes include freshwater, brackish, and salt marshes that are flooded twice daily by lunar tides. In Maryland, they are widely distributed along tidal rivers and shores of the Chesapeake Bay. Tidal freshwater marshes occur in upper sections of tidal rivers and creeks where water is consistently fresh (salinity less than 0.5 ppt). Pulses of higher salinity are common during spring high tides and episodes of low river discharge during drought cycles. The vegetation is very diverse, dominated by aquatics that are emergent at high tide. Typically there are two distinct zones in a tidal freshwater marsh: a low elevation zone dominated by short, broad-leaf emergents bordering mudflats or open water, and a slightly higher-elevation area dominated by tall graminoids. Plants in the low zone may include spadderdock, arrow arum, and pickerel weed, while higher zones often support species such as wild rice, jewelweed, sweetflag, dotted smartweed, rice cutgrass, tearthumbs, and beggar-ticks. This zonation can be attributed to flooding depth, duration, and frequency. As the salinity gradient increases downstream, subtle changes in community composition occur as plants tolerant of saltier, brackish marshes mix with predominately freshwater plants. Marshes in this zone are diverse and typically include species such as narrow-leaved cattail, saltmarsh bulrush, eastern rose-mallow, seashore mallow, and big cordgrass.

Tidal brackish marshes are transitional wetlands between tidal freshwater systems and salt marshes. They are the most extensive wetland type in Maryland occurring along the many miles of rivers and shores where the salinity of water ranges from 0.5 -18 ppt. Species diversity in brackish marshes is low and dominated by graminoids that often form extensive dense patches.

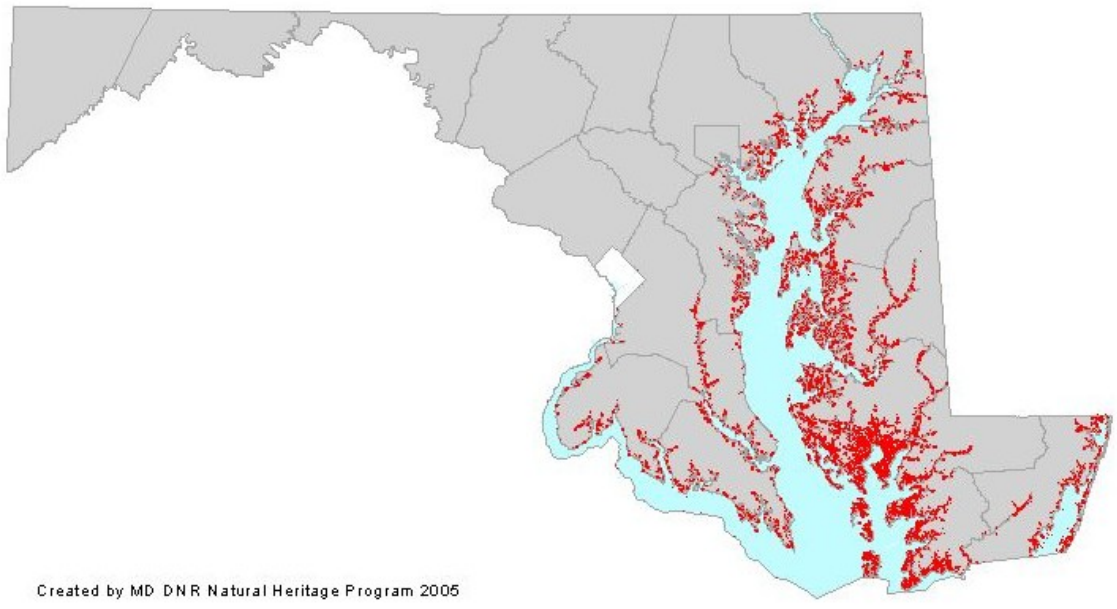
Salt marshes or salt meadows along the coast and lower portions of the Chesapeake Bay form essentially flat plains of low-statured vegetation with moderate species diversity and distinct zonation between low and high salt marshes. Lower, more regularly flooded salt zones with lower salinity are often dominated by saltmarsh cordgrass and extensive stands of black needlerush. Shorter-statured salt marshes or salt meadows are dominated by saltgrass and small saltmeadow cordgrass and generally occur on slightly elevated surfaces where tides may be less regular and where soils may concentrate salts. High salt marsh zones often support a diverse assemblage of plants that may include species such as annual salt-marsh aster, perennial salt-marsh aster, sea-oxeye, sea-lavender, glassworts, sea rose-pink, salt-marsh false foxglove, and narrow-leaved loosestrife. The salinity of tidal water is usually 18 - 30 ppt and flooding is less regular because of slightly elevated landscapes. Embedded in

some salt marshes are shallow, poorly drained depressions called "Salt panes." Like the adjacent salt marsh, salt pannes are flooded by tidal water, but water does not drain freely into creeks or guts. After a panne has been flooded the standing water evaporates and the salinity of the soil water greatly increases above the level of seawater, thus supporting the most salt-tolerant perennials and annuals, such as saltgrass, saltwort, and glassworts.

Location and Condition:

Tidal marshes are found in every county on the Coastal Plain occupying 81.8% (205,815 acres) of estuarine wetlands and 1.2% (3,799 acres) of palustrine wetlands (Tiner and Burke 1995). The best examples of tidal freshwater marshes are found on sediments deposited by large meanders of the Patuxent, Potomac, Choptank, Nanticoke, Wicomico, and Pocomoke Rivers. The majority of these marshes are in good condition however, chronic sea-level rise is advancing the salinity gradient upstream in rivers on the Atlantic Coast, leading to shifts in vegetation composition and the conversion of some tidal freshwater marshes into oligohaline marshes. Tidal Freshwater Marshes are also threatened by invasive plants such as marsh dewflower and common reed which displace native vegetation. Tidal brackish marshes are most abundant in the lower counties of the Coastal Plain such as Dorchester, Wicomico, Somerset, and Worcester Counties. Many of these marshes have been impacted by ditching, shoreline stabilization and destruction by nutria, a naturalized exotic mammal. In addition, dredge spoils and other disturbed areas often support dense, nearly monospecific colonies of common reed, a highly aggressive, invasive species that constitutes a serious threat to all tidal marshes throughout the Coastal Plain.

Figure 4.17 Location of Tidal Marshes in Maryland (Source: USFWS NWI)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals	Birds	
Least shrew	American bittern	American black duck
		American oystercatcher

American peregrine falcon	Greater yellowlegs	Tricolored heron
Bald eagle	Gull-billed tern	Whimbrel
Barn owl	King rail	Willet
Black rail	Laughing gull	Wilson's snipe
Black skimmer	Least bittern	Yellow-crowned night-heron
Black tern	Least tern	**Reptiles**
Black-bellied plover	Little blue heron	Northern diamond-backed terrapin
Black-crowned night-heron	Marsh wren	Northern red-bellied turtle
Boat-tailed grackle	Northern harrier	**Fishes**
Brant	Pied-billed grebe	Spotfin killifish
Brown pelican	Red knot	**Inverts: Dragonflies & Damselflies**
Coastal Plain swamp sparrow	Royal tern	Four-spotted pennant
Common moorhen	Ruddy duck	**Inverts: Butterflies & Moths**
Common nighthawk	Ruddy turnstone	A noctuid moth
Common tern	Saltmarsh sharp-tailed sparrow	Rare skipper
Dunlin	Sanderling	Seaside goldenrod stem borer
Eastern meadowlark	Sandwich tern	**Inverts: Beetles**
Forster's tern	Seaside sparrow	A hydrophilid beetle
Glossy ibis	Sedge wren	
Golden eagle	Semipalmated sandpiper	**Rare Natural Communities**
Grasshopper sparrow	Short-billed Dowitcher	N/A
Great blue heron	Short-eared owl	
Great egret	Snowy egret	

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, red fox, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink, northern river otter, muskrat, nutria, common snipe, Virginia rail, clapper rail, king rail, sora, Canada goose, snow goose, brant, mallard, American black duck, wood duck, gadwall, blue-winged teal, green-winged teal, northern pintail, American widgeon, northern shoveler, ring-necked duck, canvasback, redhead, hooded merganser, ruddy duck, American crow, fish crow, eastern snapping turtle, and northern diamond-backed terrapin. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

Tiner and Burke (1995) summarize the major causes of wetland loss and degradation in Maryland by the following: 1) Discharges of materials (e.g., pesticides, herbicides, other pollutants, nutrient loading from domestic sewage, urban runoff, agricultural runoff, and sediments from dredging and filling projects, agricultural lands, and other land development) into waters and wetlands, 2) Filling for dredged spoil and other spoil disposal, roads and highways, and commercial, residential, and industrial development, 3)Dredging and stream channelization for navigation channels, marinas, flood protection, coastal housing developments, and reservoir maintenance, 4) Construction of dikes, dams, levees, and seawalls for flood control, shoreline protection, water supply, and irrigation, 5) Drainage for

crop production, timber production, and mosquito control, 6) Alteration of wetland hydrology and disruption of natural river flows through diversion of fresh water for human uses (e.g., water supply, industry, and agriculture), 7) Flooding wetlands for creating ponds, waterfowl impoundments, reservoirs, and lakes, 8) Clearing of native vegetation and cultivation of agricultural crops, 9) Conversion of "natural" forested wetlands to pine siliviculture plantations, 10) Sediment diversion by dams, deep channels, and other structures, and 11) Hydrologic alterations by canals, spoils banks, roads, and other structures. Natural threats such as droughts, subsidence/sea-level rise, storm events, erosion, and mechanical damage by wildlife (e.g., muskrats, mute swans, snow geese, Canada geese) could also have severe impacts on wetlands systems.

a. Conversion to agriculture that results in loss of habitat
b. Development and land use, including roadways, that result in fragmentation and isolation
c. Incompatible agricultural practices, such as ditching, channelization, pond construction, livestock grazing, and inadequate buffers, that result in habitat degradation
d. Hydrologic changes from residential development, agricultural practices, mining, and other impacts such as ditching, water withdrawal, and pond construction
e. Reduced water quality through chemical contamination, siltation, and pollution
f. Invasive species that result in degradation of habitat
g. Pesticide use and contamination that directly or indirectly affects GCN species
h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
i. Eutrophication, siltation, and pollution of habitat primarily by pesticide and nutrient contamination
j. Sea-level rise, subduction, and increased erosion rates that result in loss of habitat and increased flooding events
k. Channalization, piers, docks, and boat wakes that result in habitat degradation
l. Shoreline stabilization through rip-rap placement and bulkhead construction
m. Contamination from oil spills, boat fuels, and other sources of harmful chemicals
n. Impoundments

Conservation Actions:

a. **Limit development impacts within wetland areas and surrounding watershed** ***[Measure: # of development projects implementing BMPs to limit surrounding wetland impacts; % of development permits denied for wetland protection]***
b. **Protect appropriate buffers for tidal marshes through acquisition and easements** ***[Measure: # of acres of appropriate wetland buffers protected]***
c. **Restore and enhance breeding and nonbreeding habitats of high priority GCN species** ***[Measure: # of acres restored and enhanced]***
d. **Develop and implement protocols to control invasive species and prevent their establishment** ***[Measure: # of protocols developed; # of sites with management implemented]***
e. **Initiate coordinated efforts to conserve habitat and maintain the integrity of wetland systems across wide geographic areas, including targeting the highest quality areas** ***[Measure: # of acres targeted tidal marshes conserved]***
f. **Develop and implement methods to restore hydrology to wetlands degraded by ditching** ***[Measure: # of protocols developed; # of acres of ditched marshes with hydrology restored]***

g. **Protect wetlands from drainage, ditching, filling, water withdrawal, and other damaging practices that alter hydrology** ***[Measure: # of acres of wetlands protected from practices that alter hydrology]***
h. **Minimize mosquito control practices to those conducive to GCN species** ***[Measure: # of acres with compatible pest management implemented; # of local, state, and federal agency plans incorporating compatible pest management]***
i. **Restore wetlands where appropriate** ***[Measure: # of acres wetlands restored]***
j. Reduce impacts of water pollution from boats and other sources *[Measure: # of guidelines developed and distributed; # of sites with guidelines implemented]*
k. Protect wetlands through acquisitions and easements *[Measure: # of acres of wetlands newly protected through acquisitions and easements]*
l. Acquire habitat through the North American Wetland Conservation Act (NAWCA) *[Measure: # of acres acquired through NAWCA program]*
m. Implement BMPs and adaptive management methods for tidal marshes and associated impoundments *[Measure: # of sites with BMPs implemented; # of BMPs incorporated into local, state, and federal agency plans]*
n. Develop new technologies to accelerate tidal marsh accretion *[Measure: # of protocols developed and evaluated for effectiveness; # of sites with protocols implemented]*
o. Minimize runoff from roads, including silt, salt and contaminants *[Measure: # of sites with improved runoff BMPs implemented]*
p. Strictly enforce existing federal and state wetland protection laws *[Measure: # of violations prosecuted; # of citations issued]*
q. Utilize U.S. Army Corp of Engineers and MDE regulatory processes to protect tidal marsh habitat *[Measure: # of acres of habitat protected via wetlands regulatory processes]*
r. Minimize and reduce habitat fragmentation *[Measure: # of development projects designed and developed to minimize habitat fragmentation]*
s. Incorporate wetland conservation actions into land planning efforts and public land management plans *[Measure: # of acres of wetlands conserved during land use and land planning efforts; # of public land management plans incorporating wetland wildlife focused habitat conservation actions]*
t. Collaborate with the implementation of the North American Waterfowl Plan *[Measure: # of joint cooperative conservation projects implemented; # of acres protected under cooperative projects]*
u. Work with watershed groups, watershed-based initiatives, landowners, and federal programs to expand and coordinate wetland conservation efforts *[Measure: # acres of wetlands conserved through expanded and coordinated multi-partner cooperative programs]*
v. Better train certified wetland delineators to identify wetland types *[Measure: # of certified wetland delineators with updated training]*
w. Work with landowners and farming community to develop and encourage BMPs for agricultural practices *[Measure: # of BMPs developed and promoted; # of sites with BMPs implemented]*
x. Work with Maryland DOT to minimize wetland impacts and explore offsite mitigation for wetland complexes *[Measure: # or miles of new roads planned with comments/input to minimize wetland impacts; # of offsite mitigation projects established]*

Inventory, Monitoring and Research Needs:

a. Determine precise habitat characterizations and needs of high priority GCN species, including area sensitivity, habitat quality, and habitat availability *[Measure: # of research projects conducted; # of research papers published]*
b. Determine management needs and best management practices for populations, especially effects of various marsh management practices on species' productivity and on long-term habitat suitability *[Measure: # of research projects conducted; # of research papers published; # BMP's developed]*

c. Develop regional, standardized methodologies for effective assessment of population abundance, trends, distribution, and movement patterns, and for improved monitoring of Maryland populations *[Measure: # of research projects conducted; # of research papers published; # of standardized methodologies developed]*
d. Conduct studies on the factors limiting species abundance, such as predation rates, reproductive success, contamination, and prey availability *[Measure: # of research projects conducted; # of research papers published]*
e. Monitoring programs should accompany management activities to assess effects of techniques on GCN species and long-term habitat suitability *[Measure: # of monitoring programs conducted; # of conservation actions modified and re-prioritized based on evaluation of effectiveness]*
f. Establish long-term habitat monitoring programs *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
g. Develop more effective methods of controlling phragmites *[Measure: # of methods tested; # of methods developed]*